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Barrett et al.

(10) **Patent No.: US 7,530,213 B2**
(45) **Date of Patent: May 12, 2009**

(54) **MANUAL CAPSULE LOADING MACHINE**

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(73) Assignee: **Dene Barrett**, Frazier Park, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) Filed: **Dec. 17, 2007**

(65) **Prior Publication Data**

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Related U.S. Application Data

(62) Division of application No. 11/297,239, filed on Dec. 9, 2005, now Pat. No. 7,337,596.

(51) **Int. Cl.**
B65B 35/56 (2006.01)

(52) **U.S. Cl.** **53/531**; 53/900; 53/544; 53/266.1; 53/390; 53/268

(58) **Field of Classification Search** 53/266.1, 53/268, 390, 281, 900, 531, 544
See application file for complete search history.

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(57) **ABSTRACT**

A capsule orienting and separation apparatus is provided which allows a multiplicity of gelatin capsule shells to be uniformly oriented in a separable condition and for the caps of those shells to be separated from the capsule bodies. The apparatus allows a multiplicity of capsule shells all to be concurrently oriented in an upright disposition by a manually operated mechanism. The capsule caps are all uniformly oriented atop the capsule bodies and are exposed for gripping by a capsule cap lift assembly. The capsule caps are concurrently lifted from the capsule bodies while the capsule bodies remain in position in a matrix of openings in a capsule receiving tray. The capsules can then be filled with capsule filler material and tamped down as appropriate. The capsule caps are then all concurrently replaced on the capsule bodies and the capsule caps and capsule bodies are then concurrently permanently sealed together. All of the steps of orientation, filling, and sealing are performed with a manually operable mechanism.

7 Claims, 27 Drawing Sheets

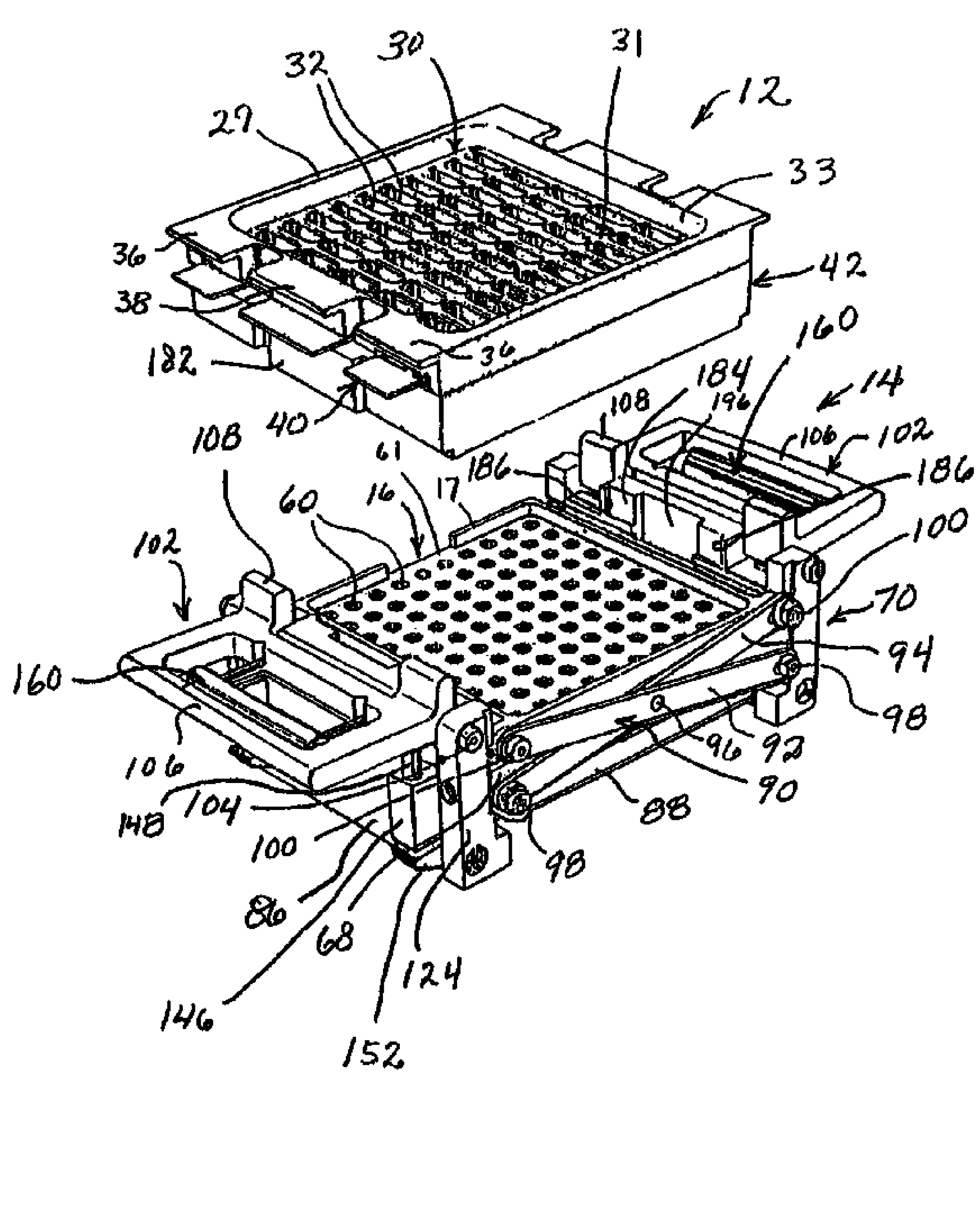

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FIG. 1

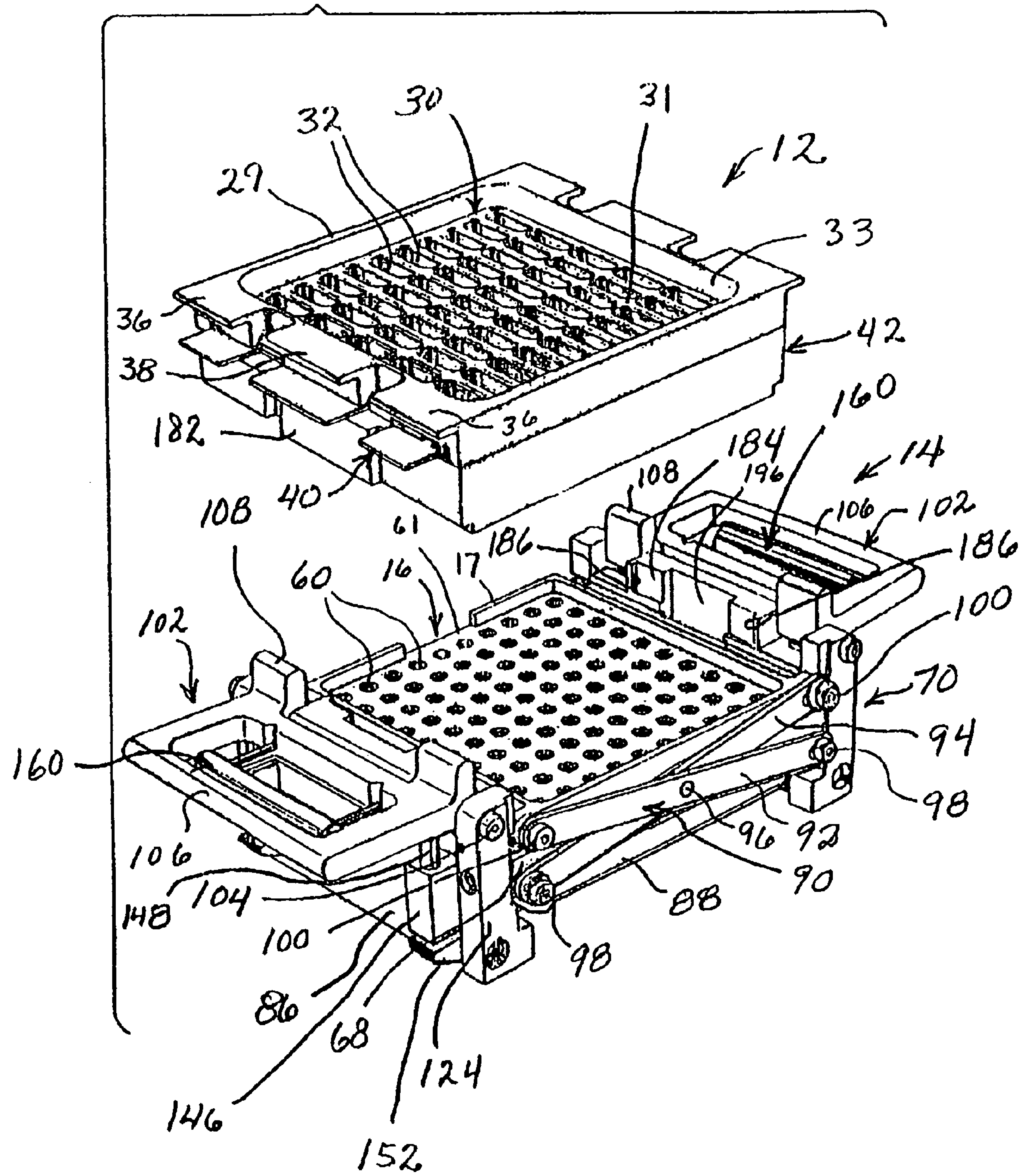

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FIG. 2

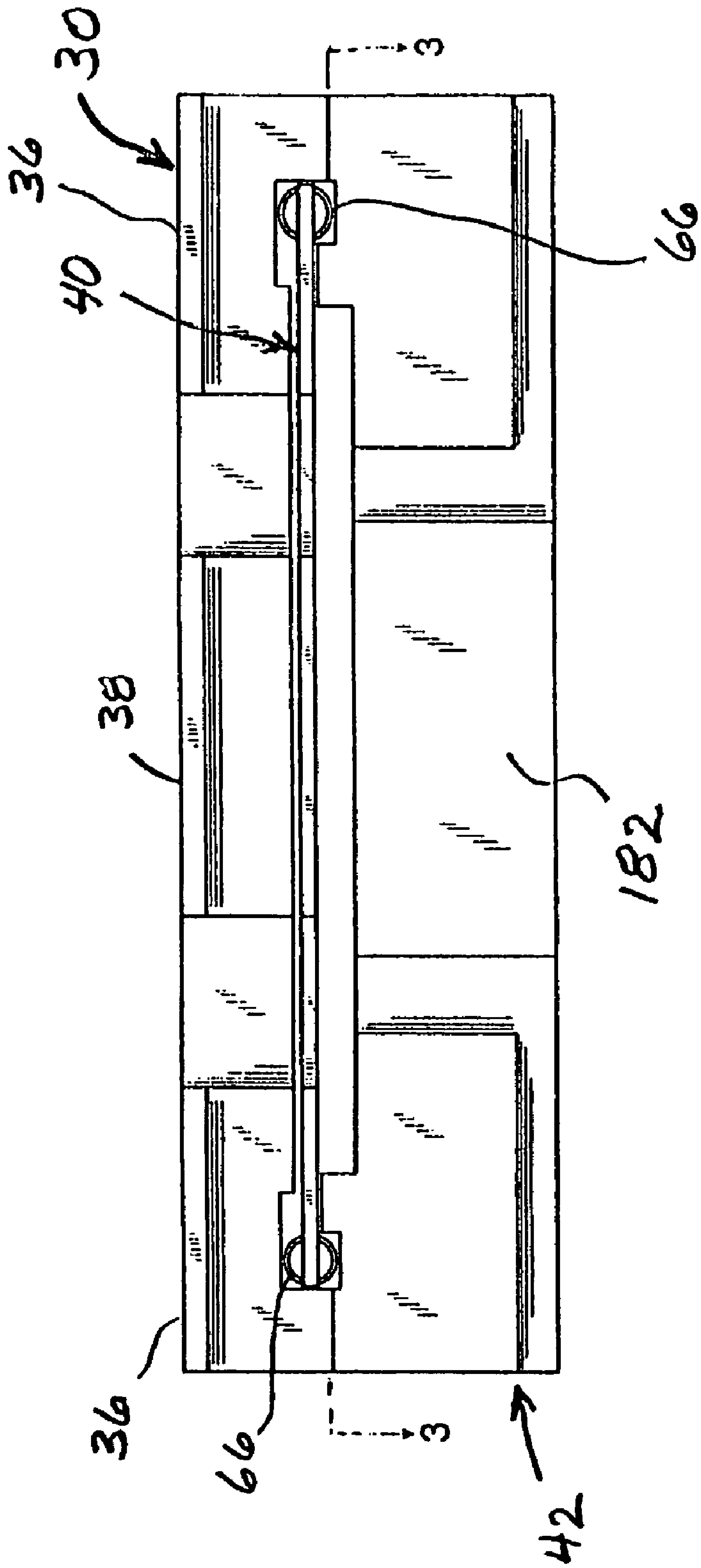
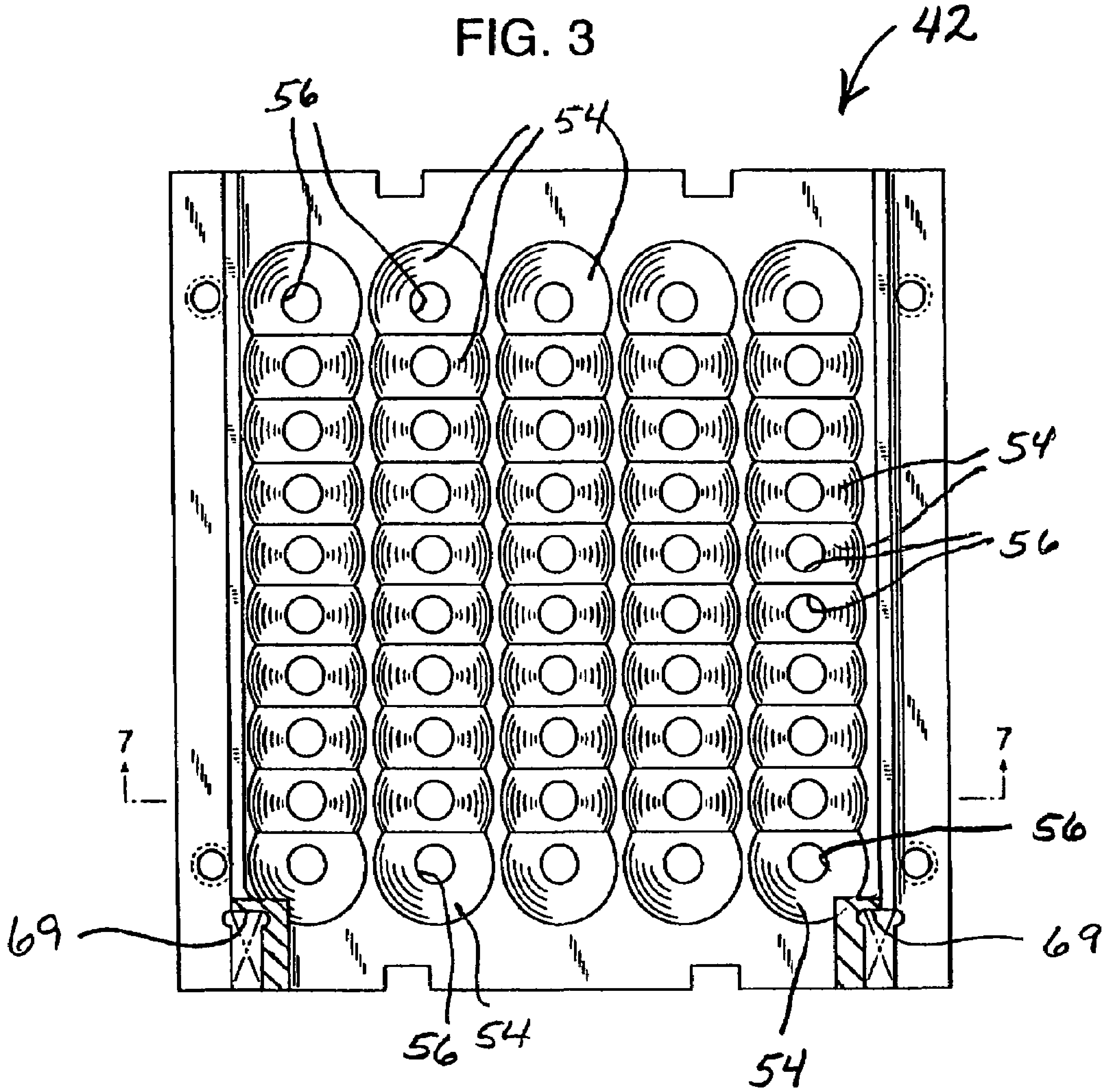


FIG. 3



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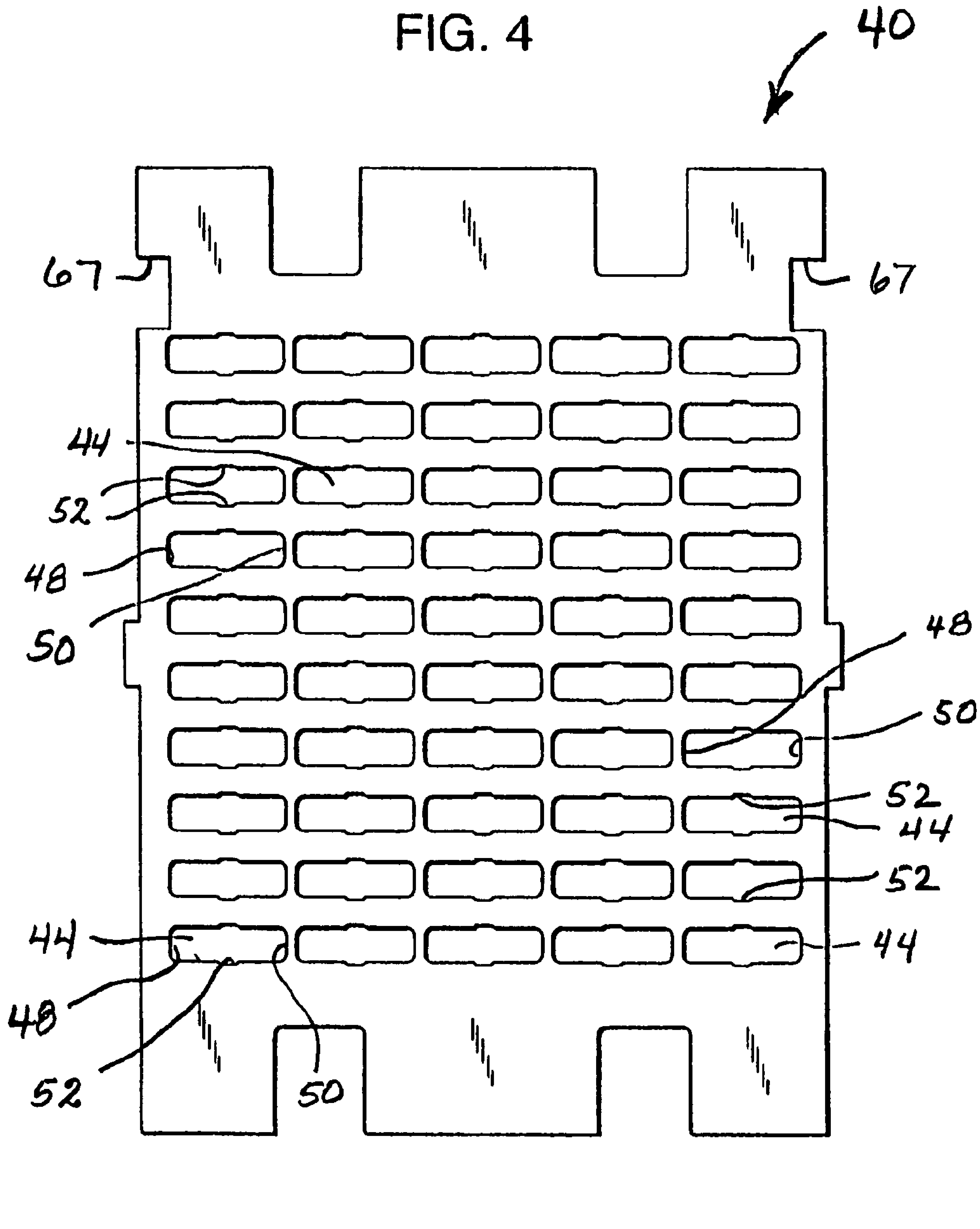

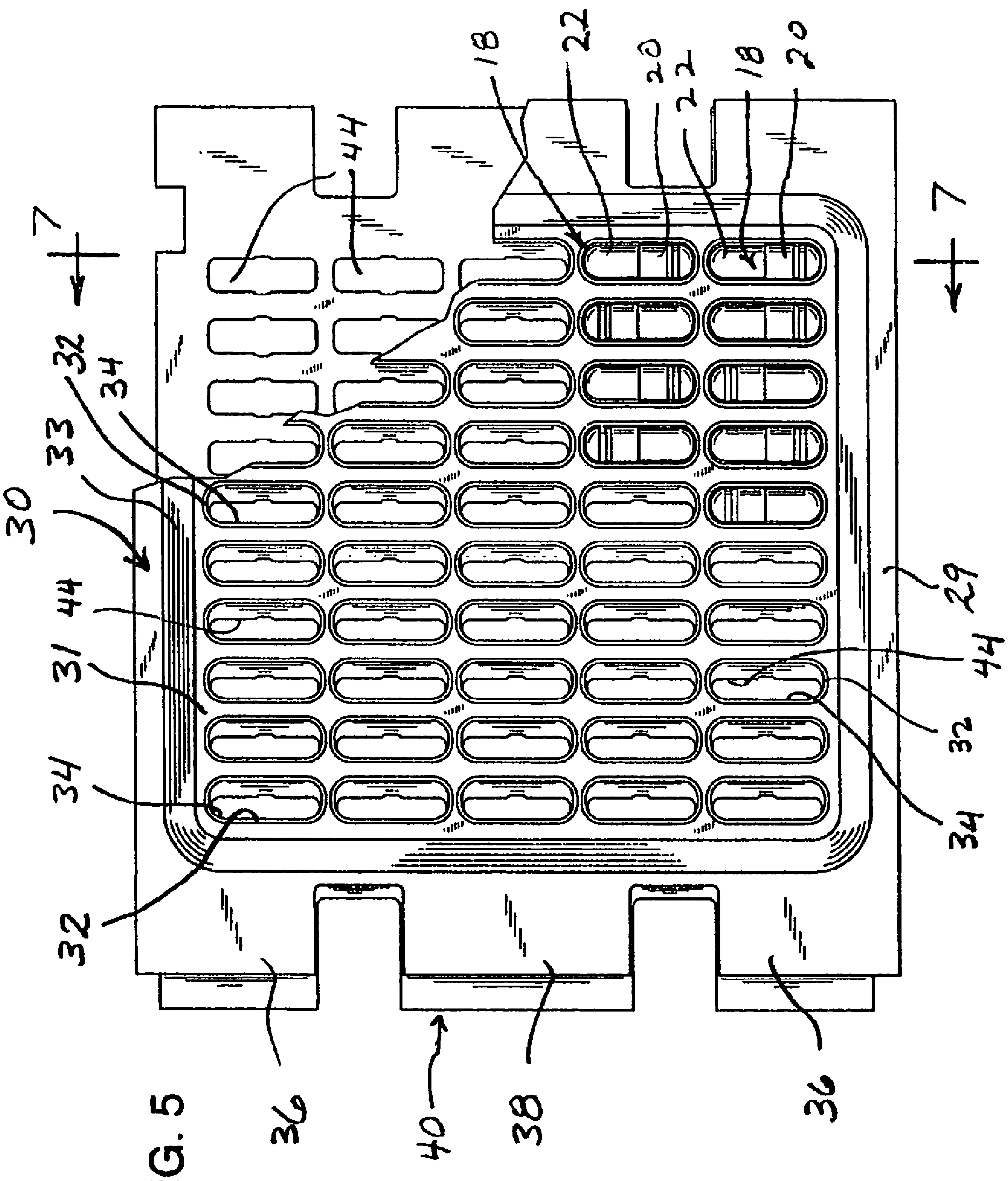

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FIG. 5

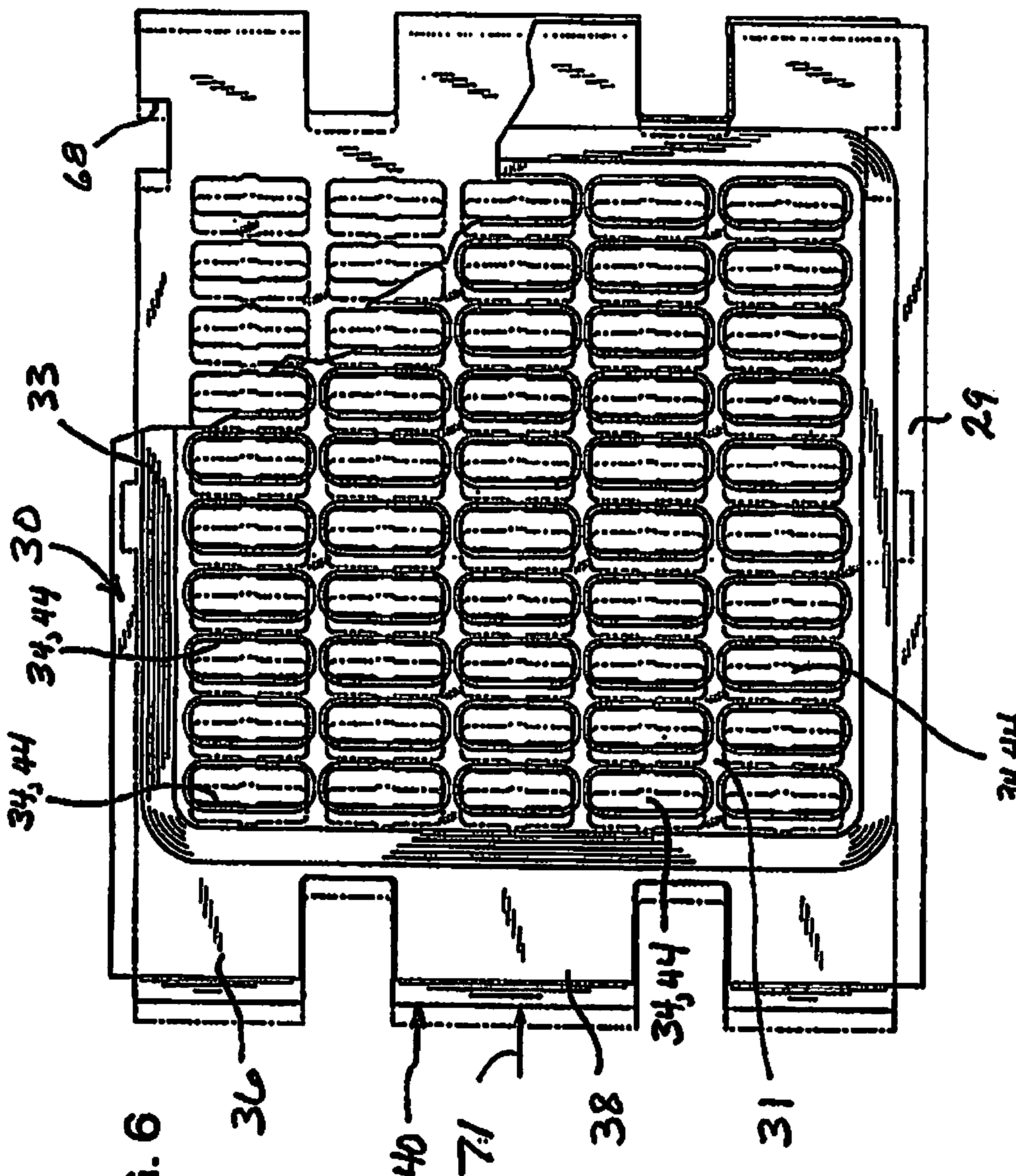

FIG. 6

FIG. 7

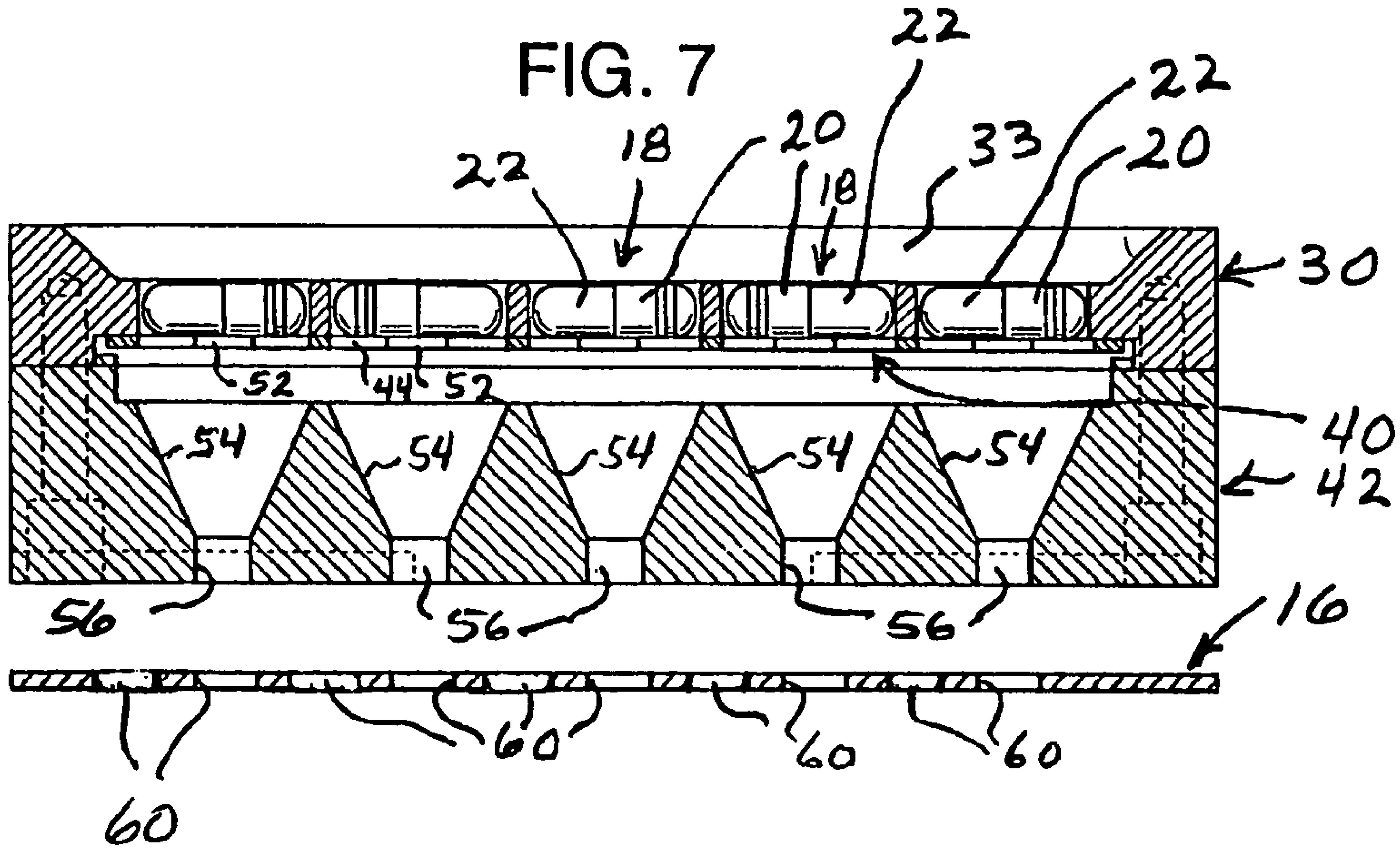
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FIG. 8

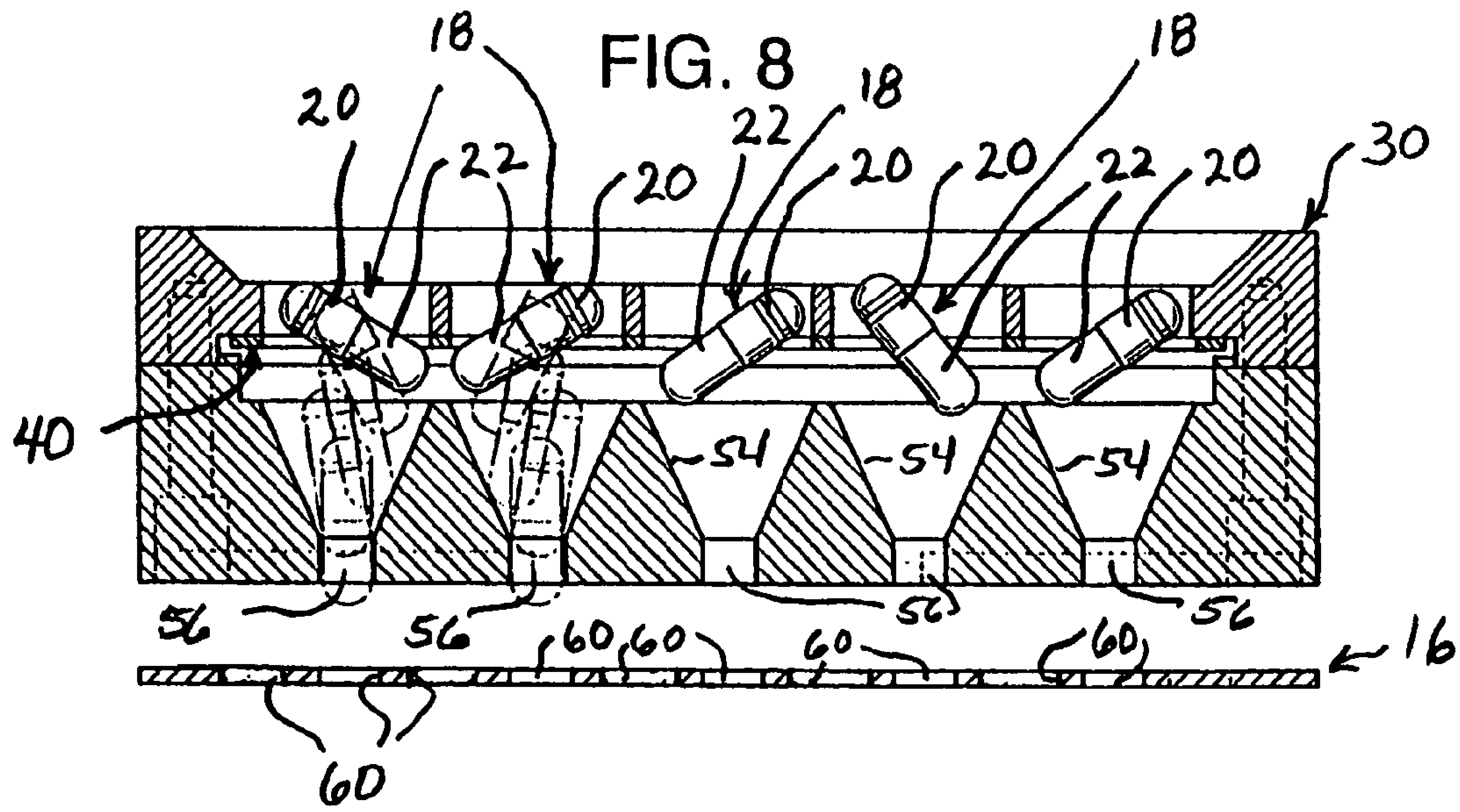
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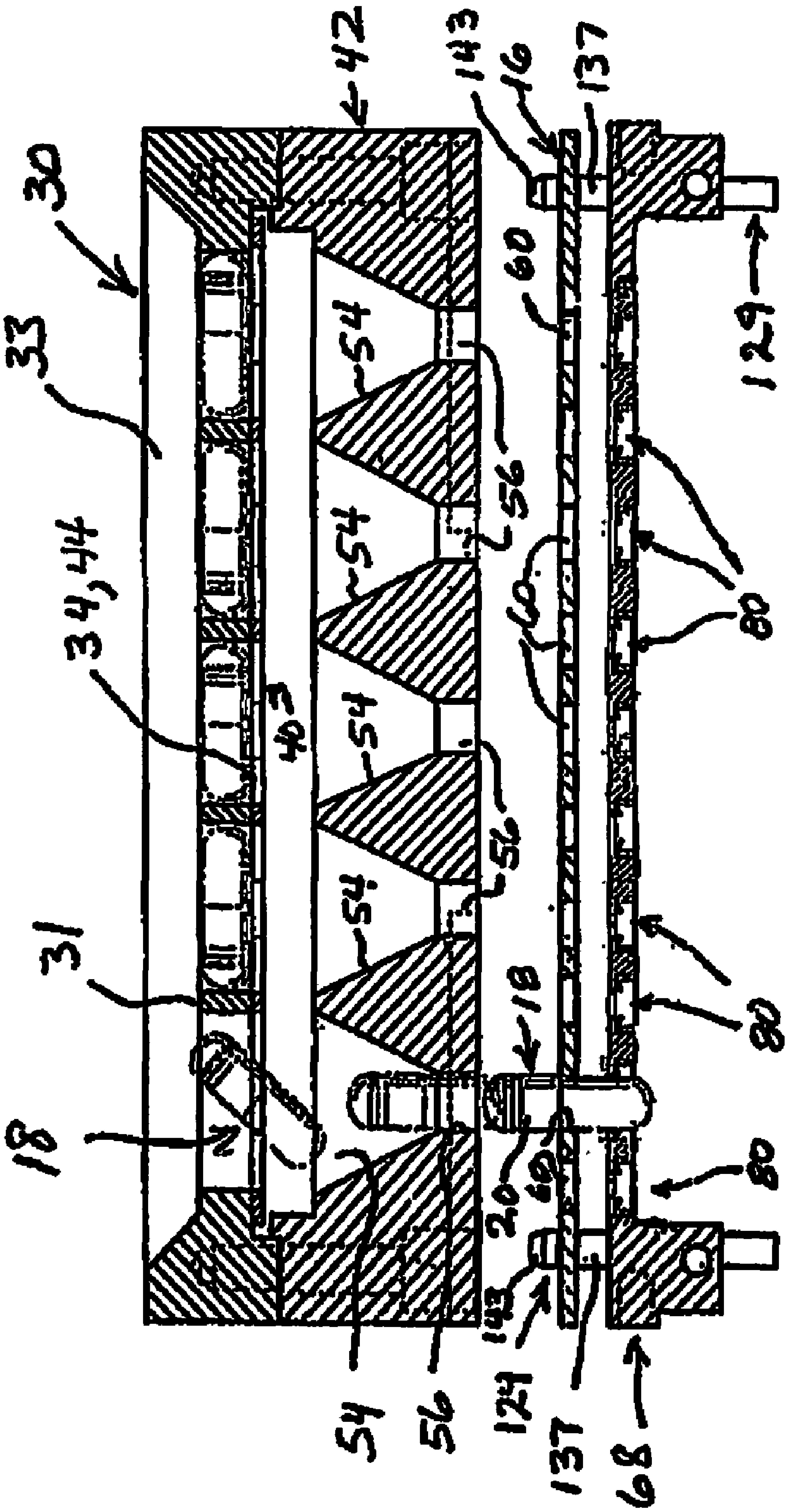
FIG. 9



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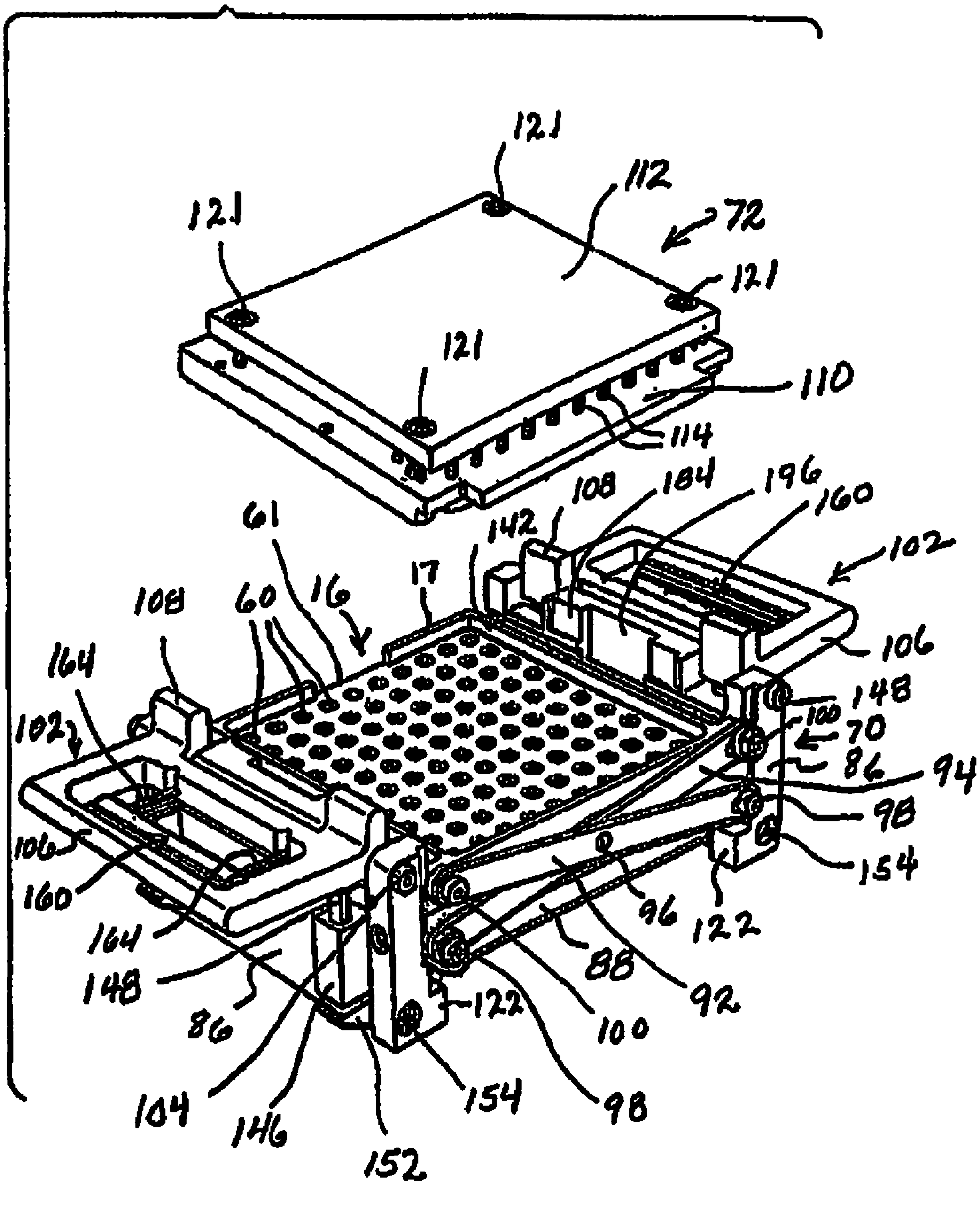
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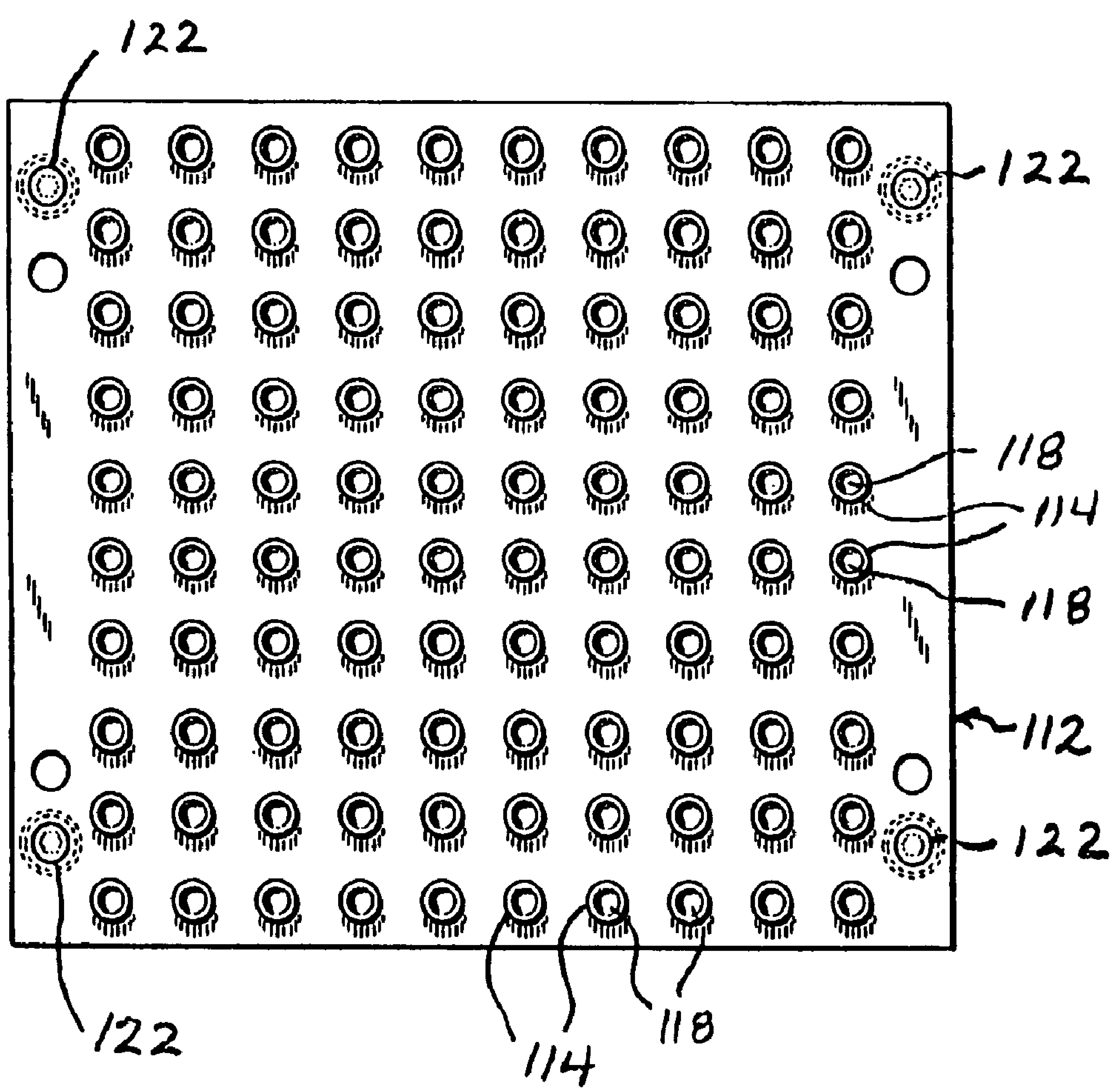
FIG. 11



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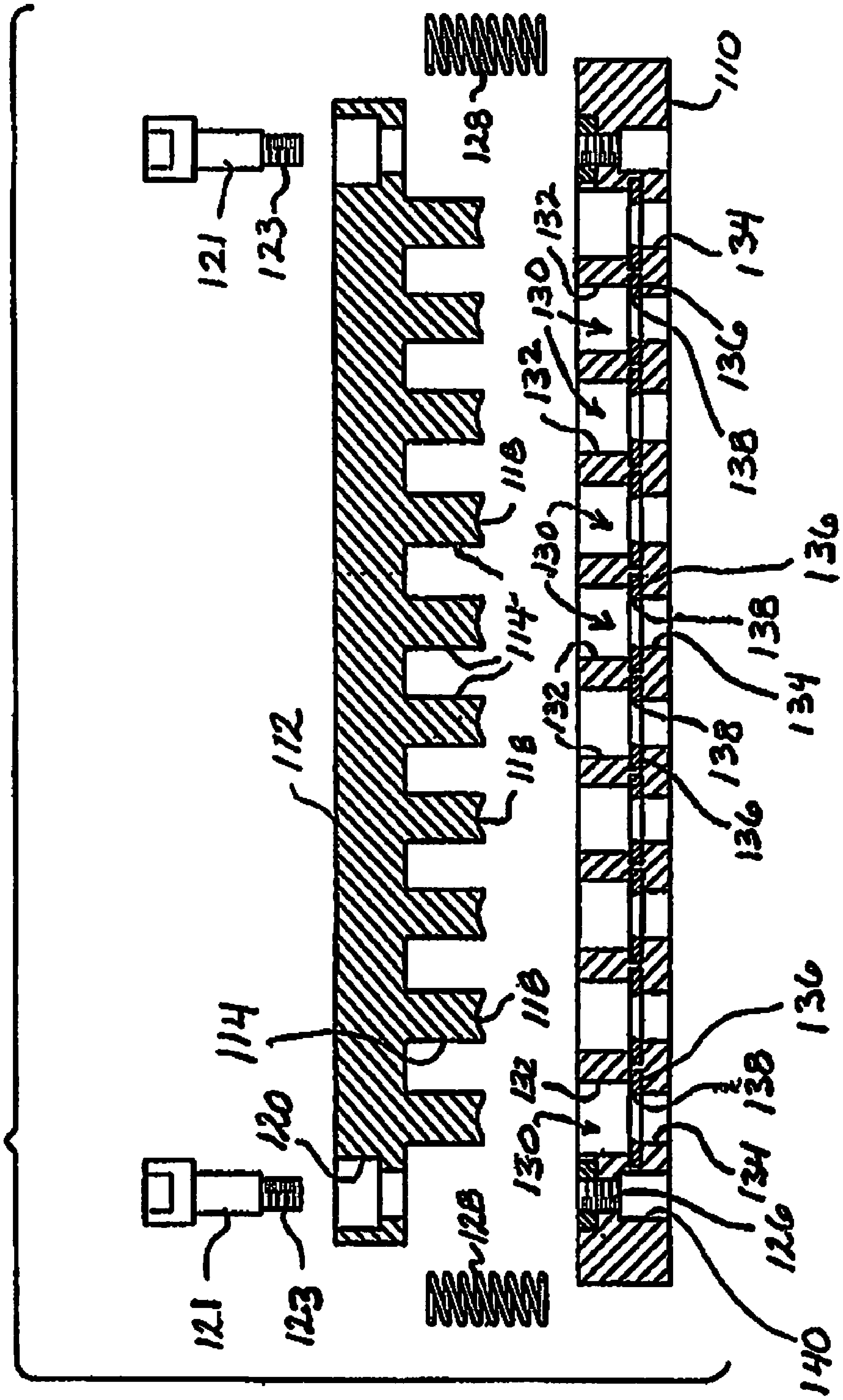

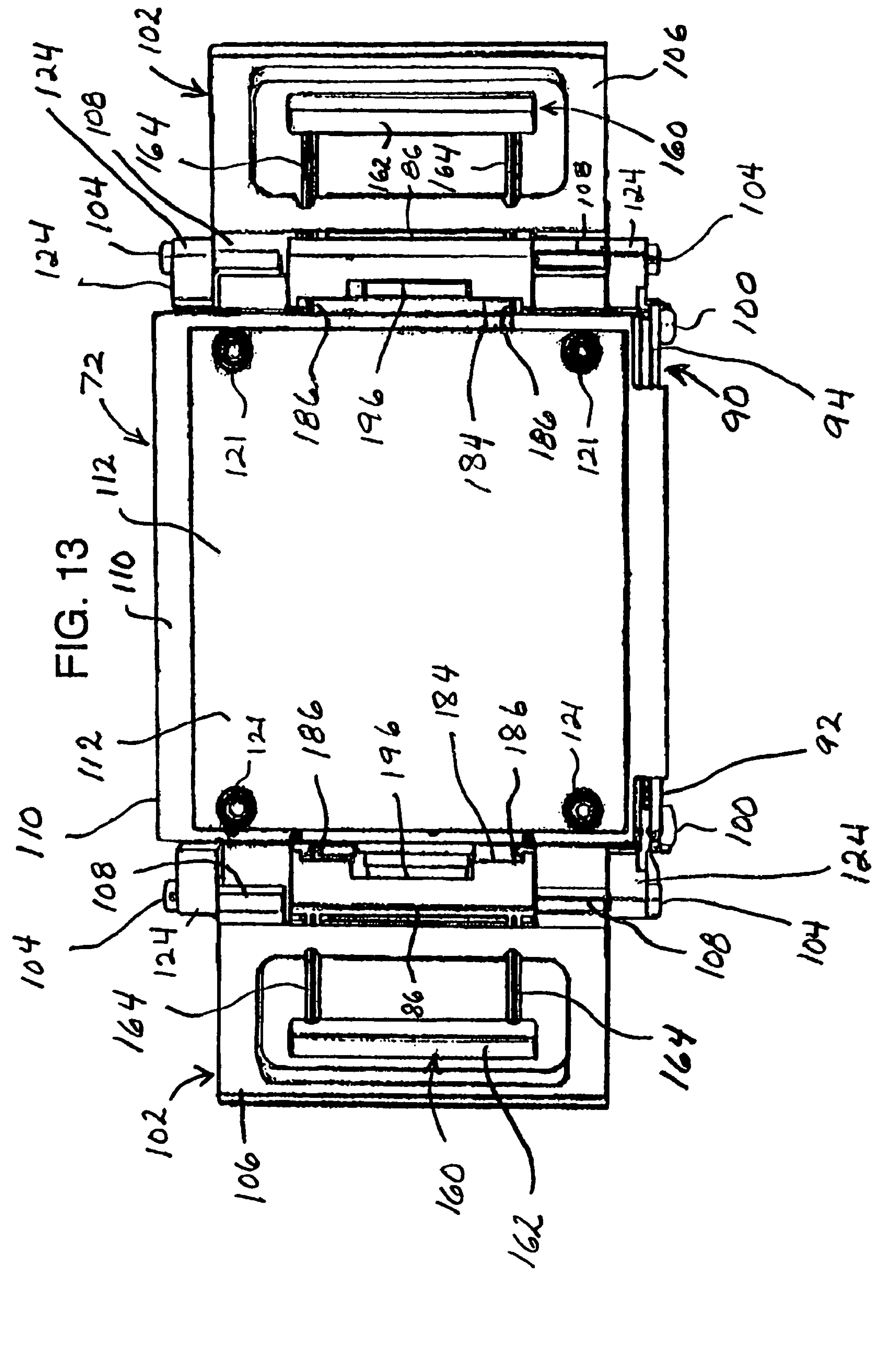
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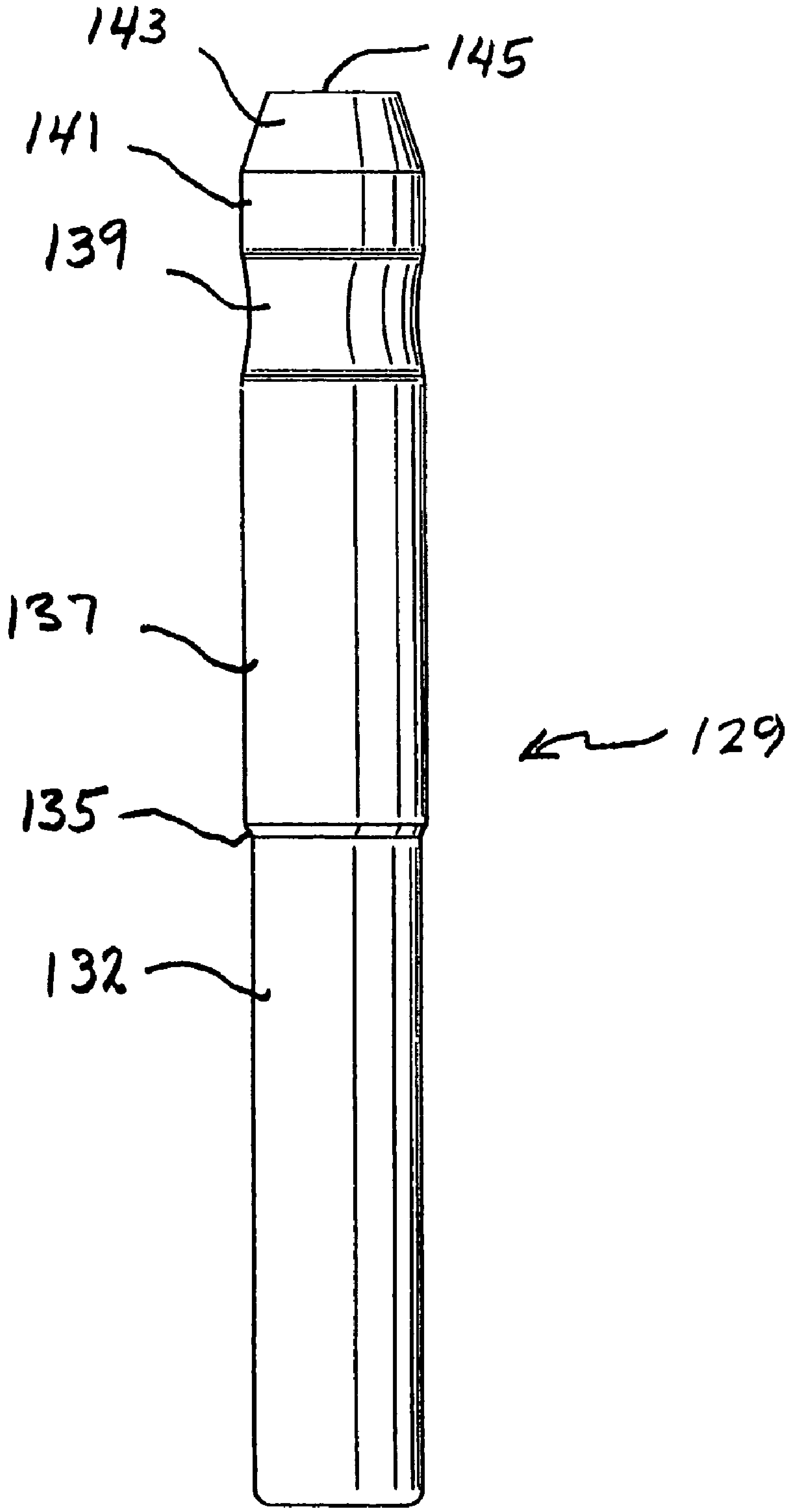
FIG. 13

FIG. 14



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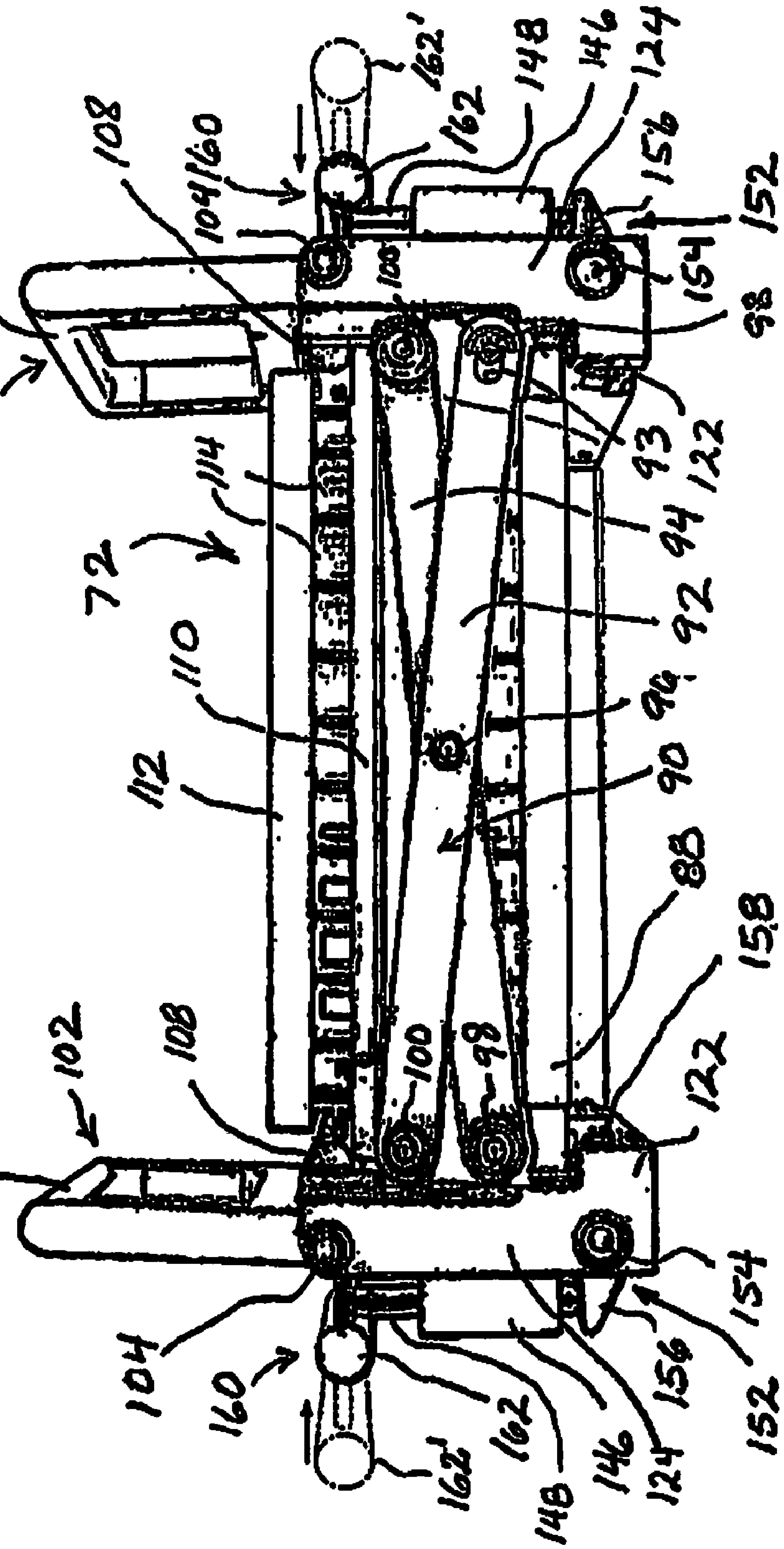

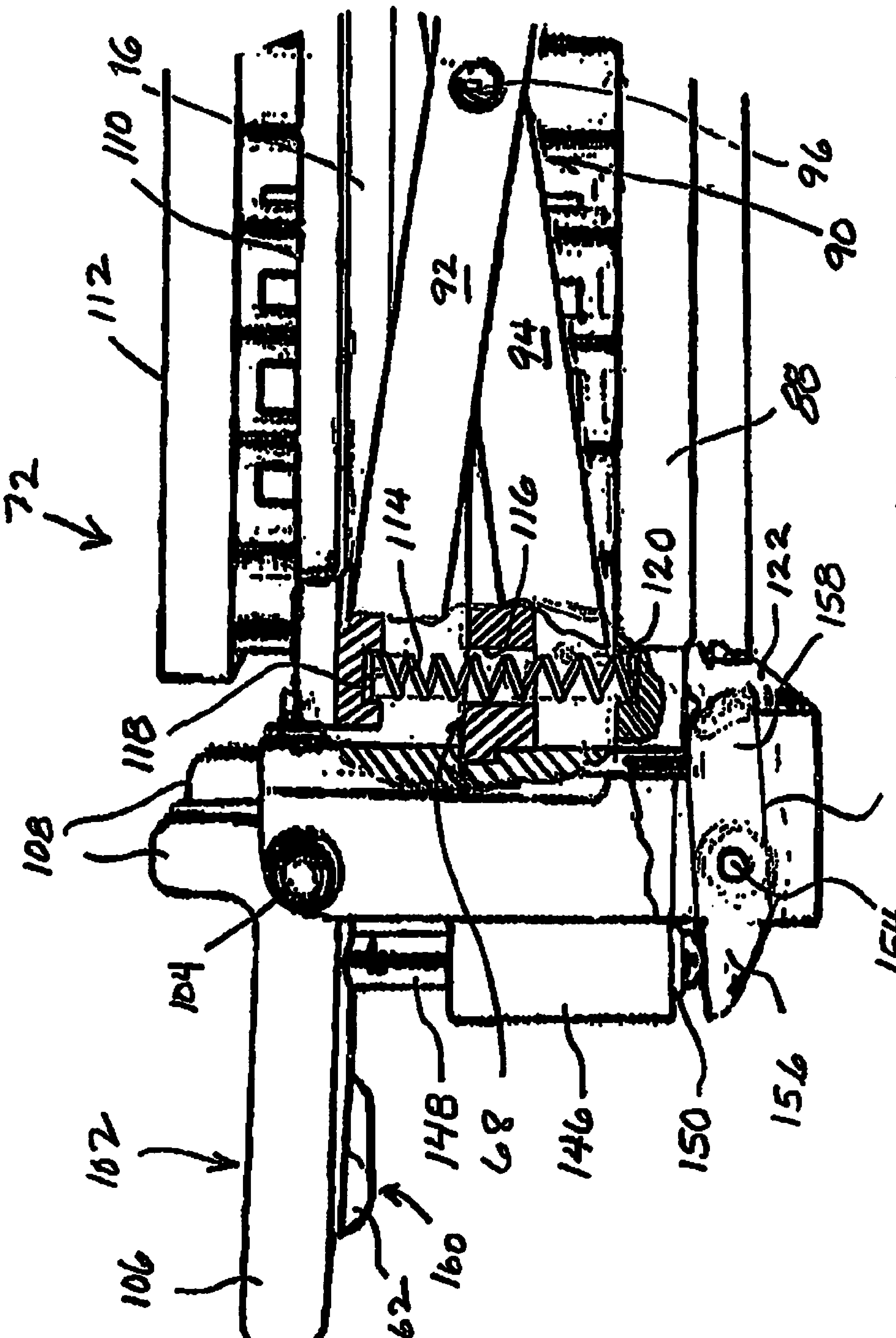
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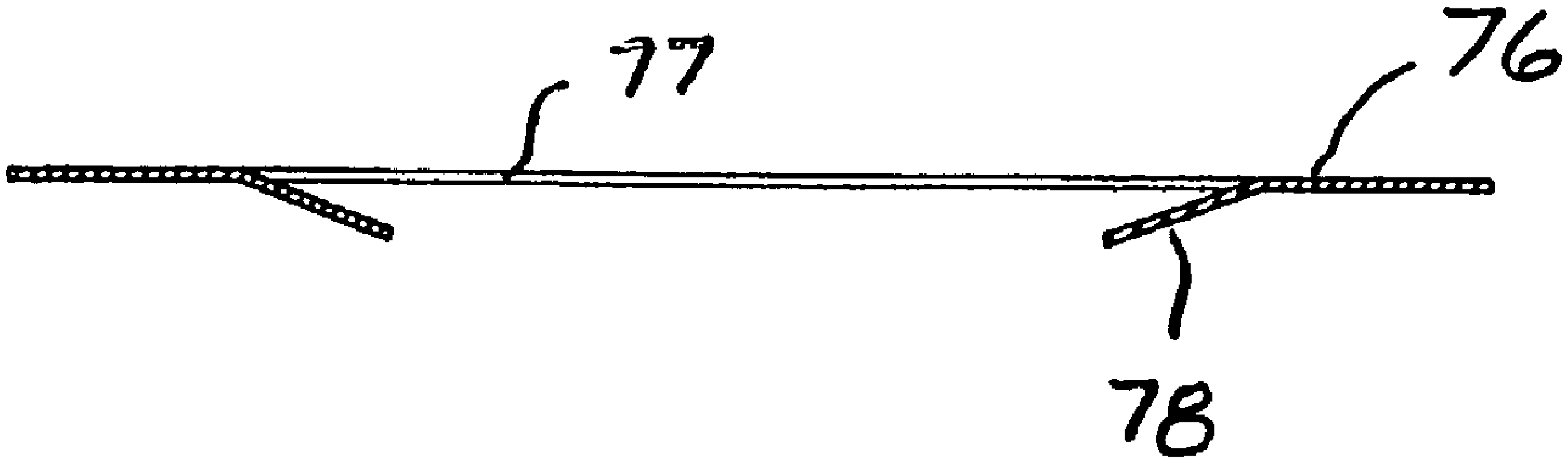
FIG. 16

FIG. 17



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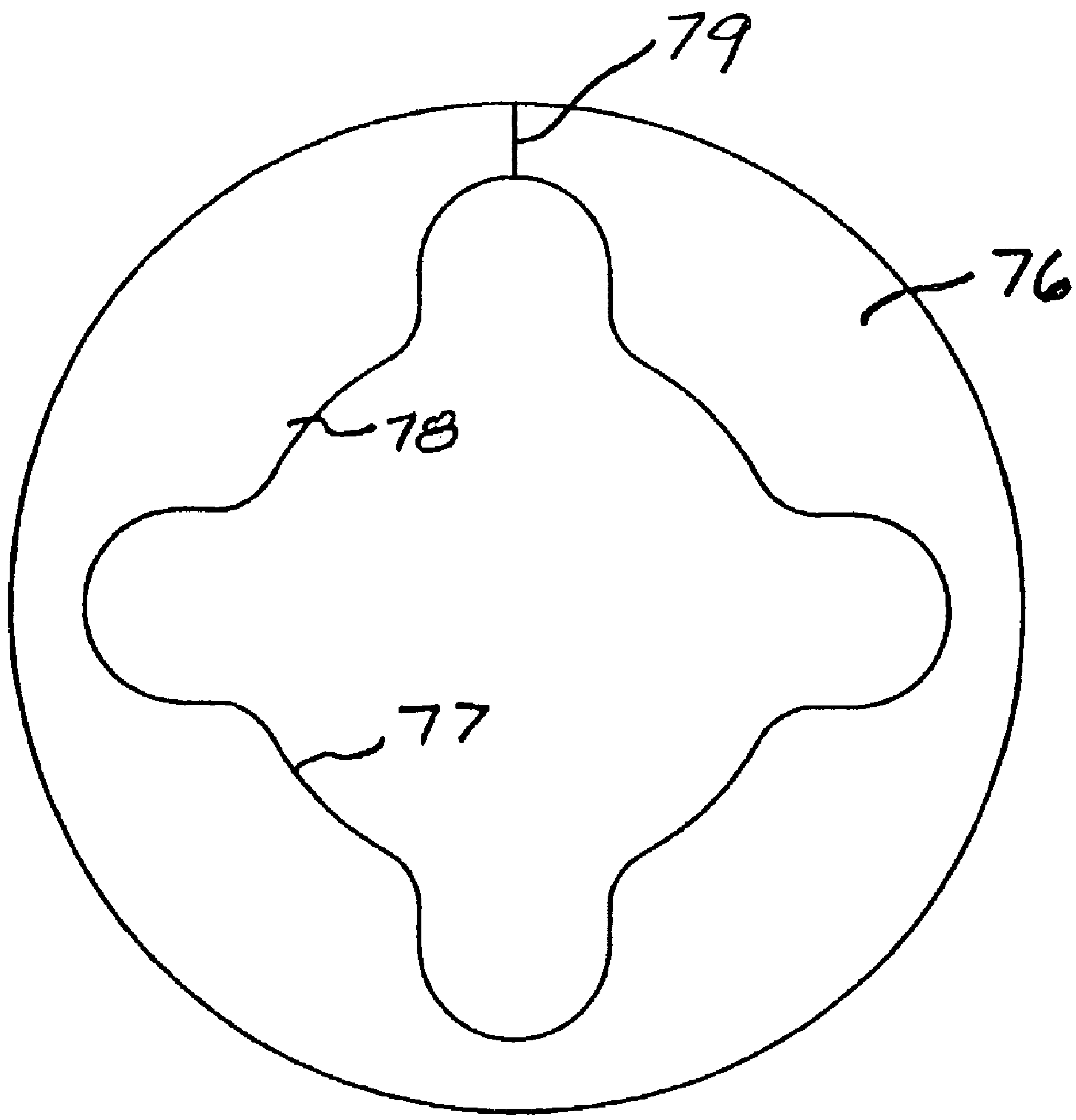

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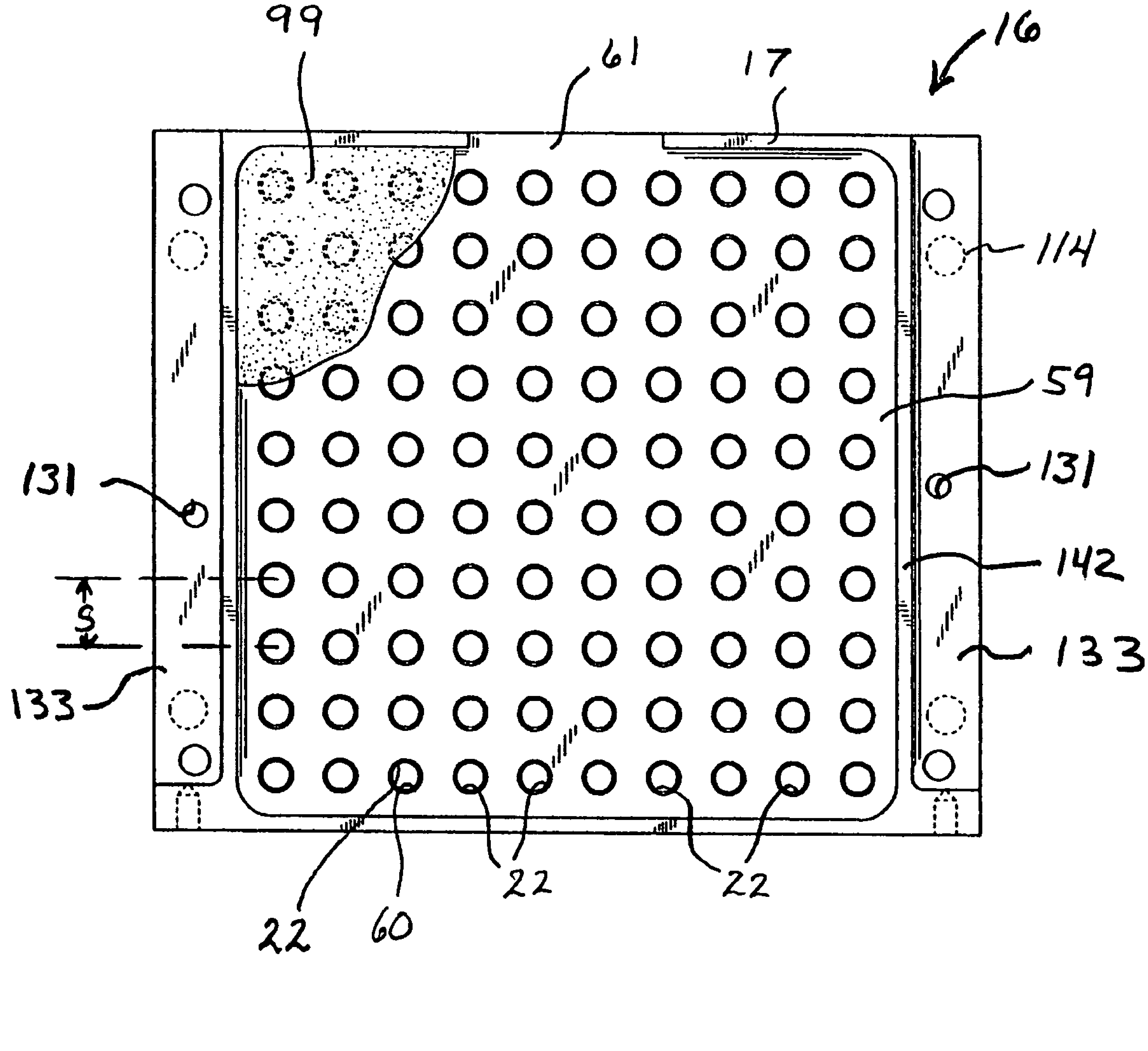

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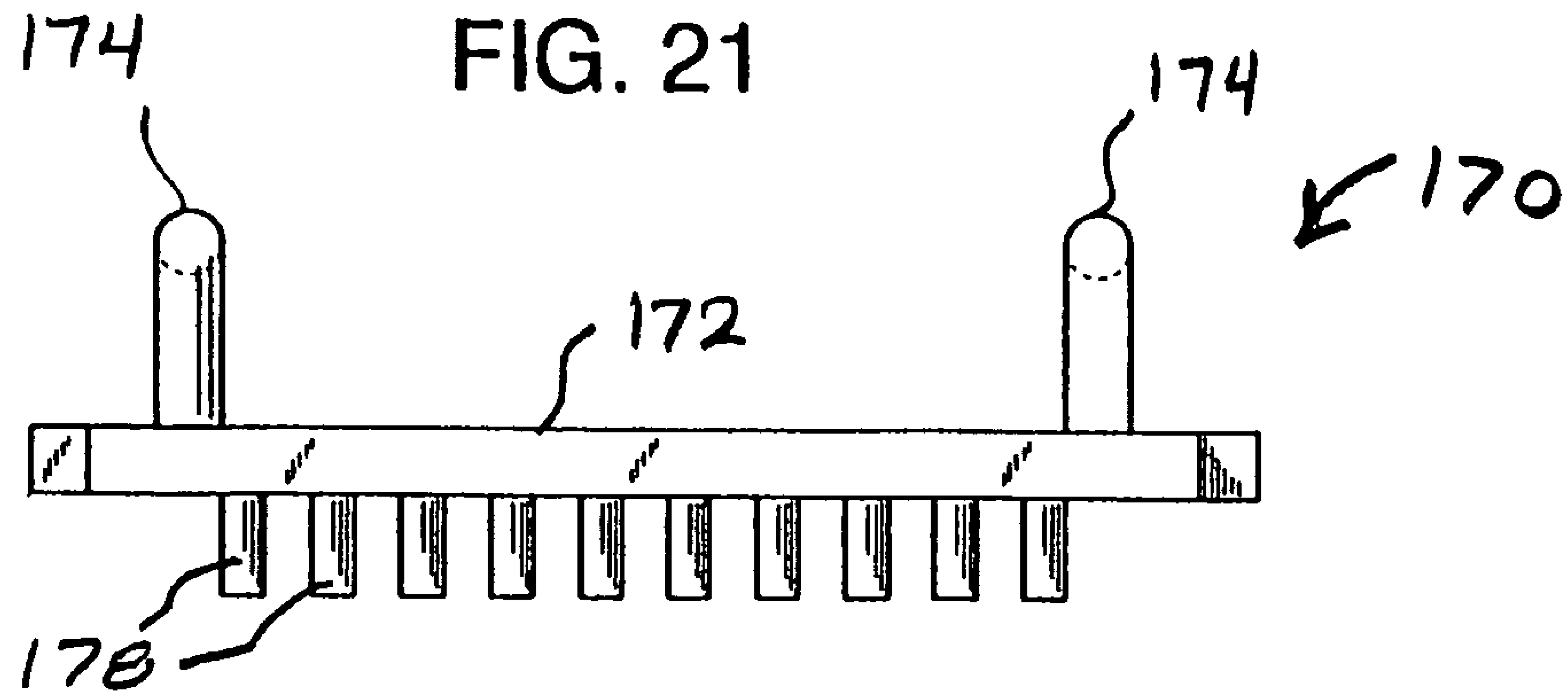

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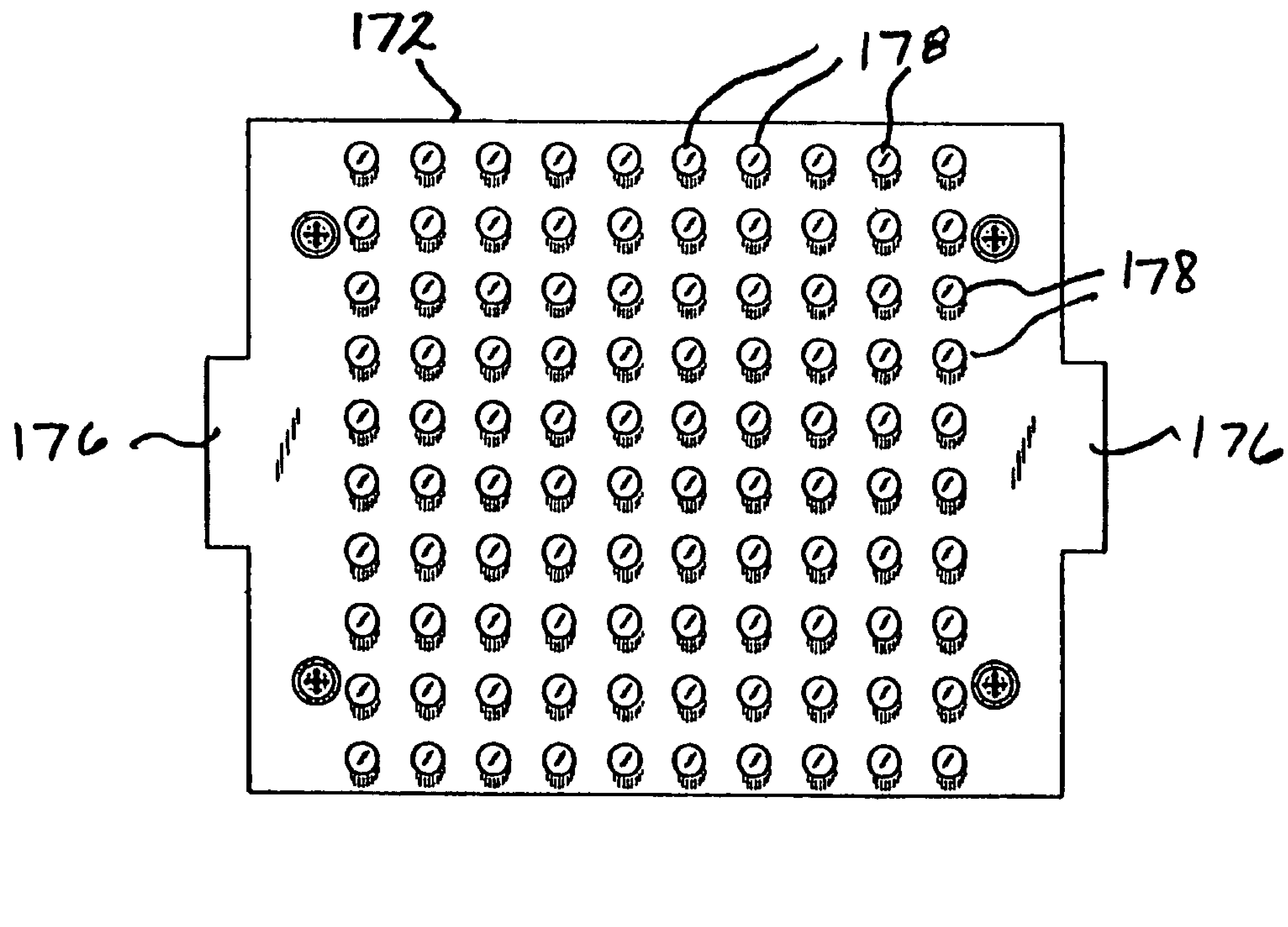

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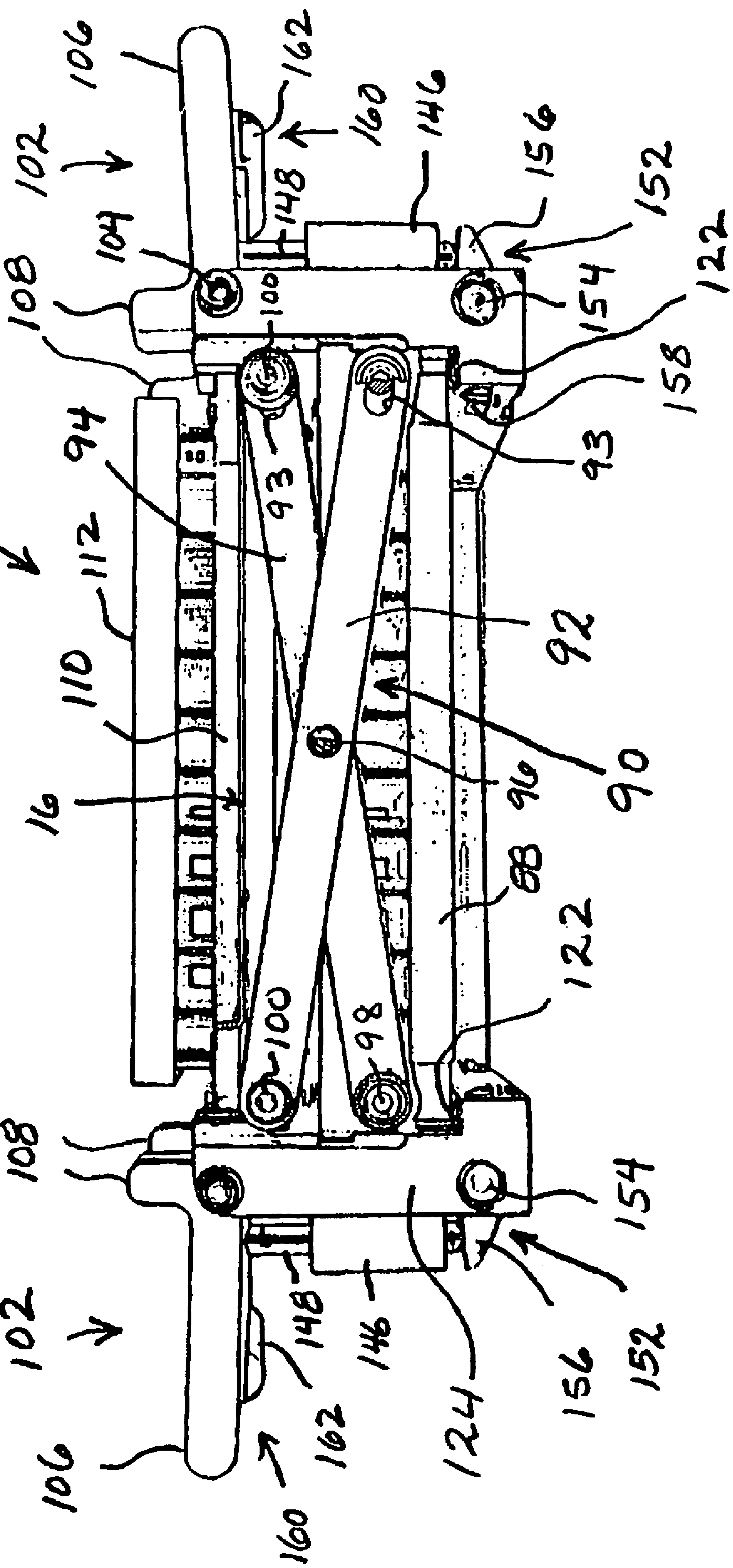
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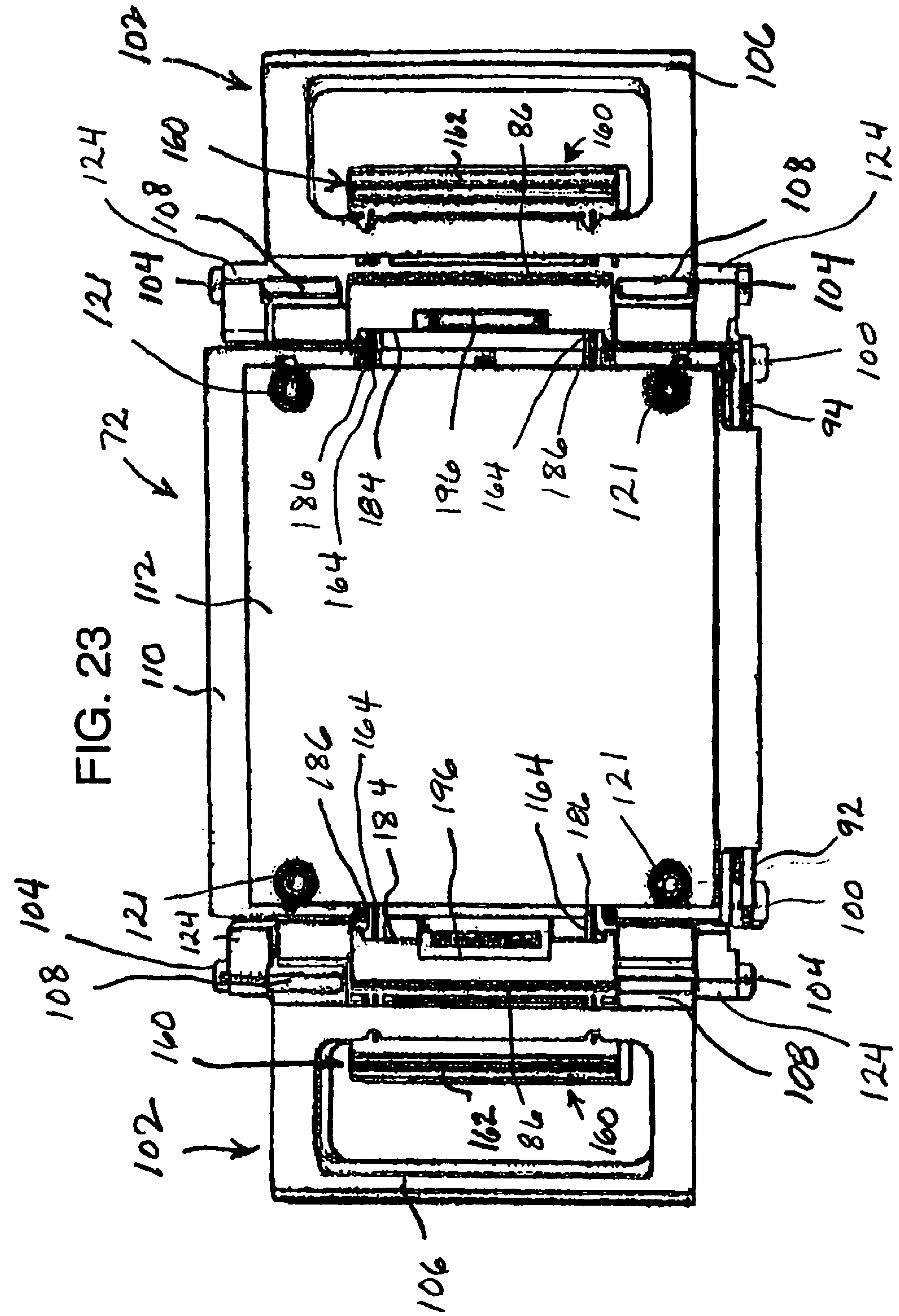
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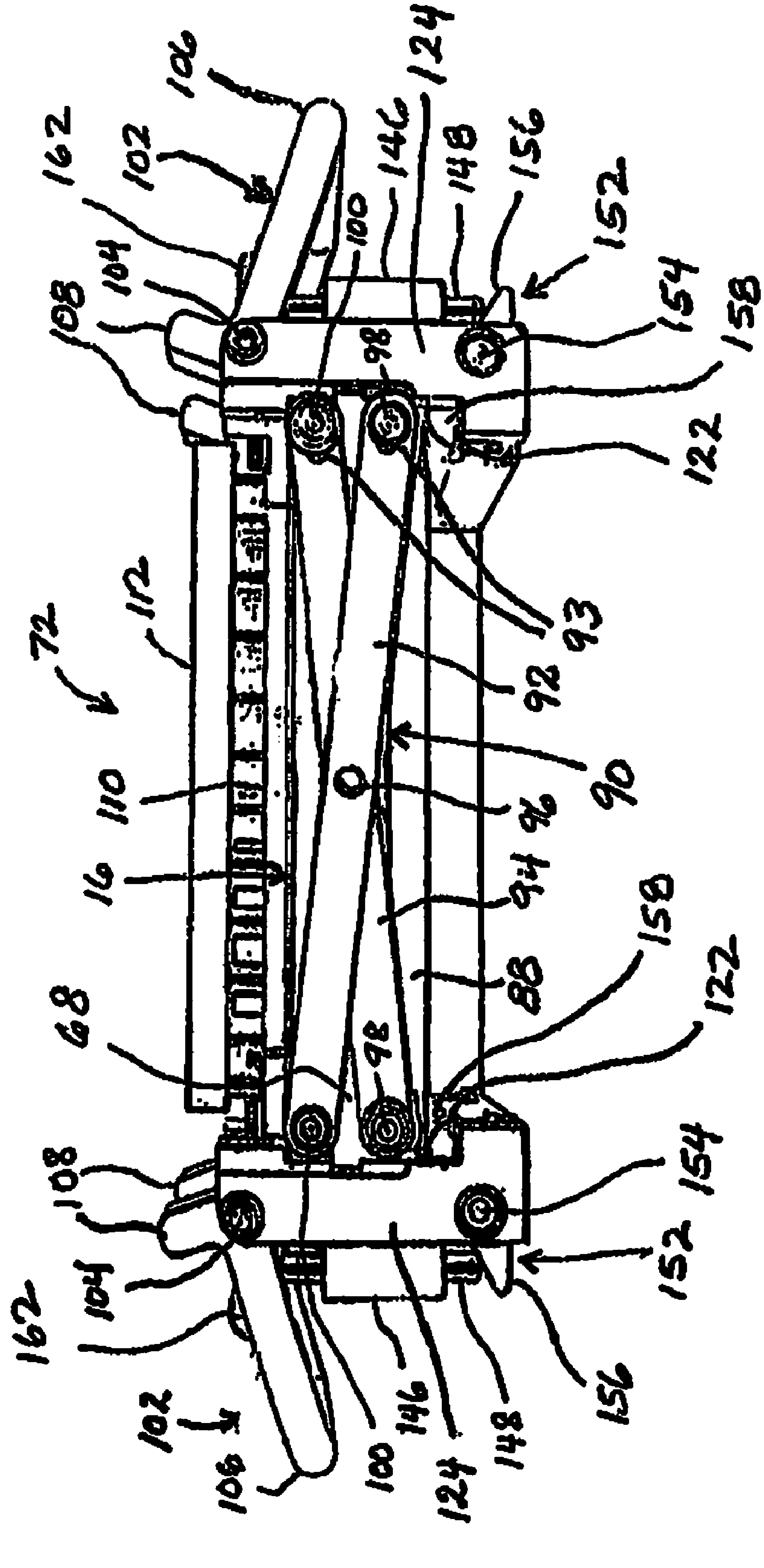
FIG. 23

FIG. 24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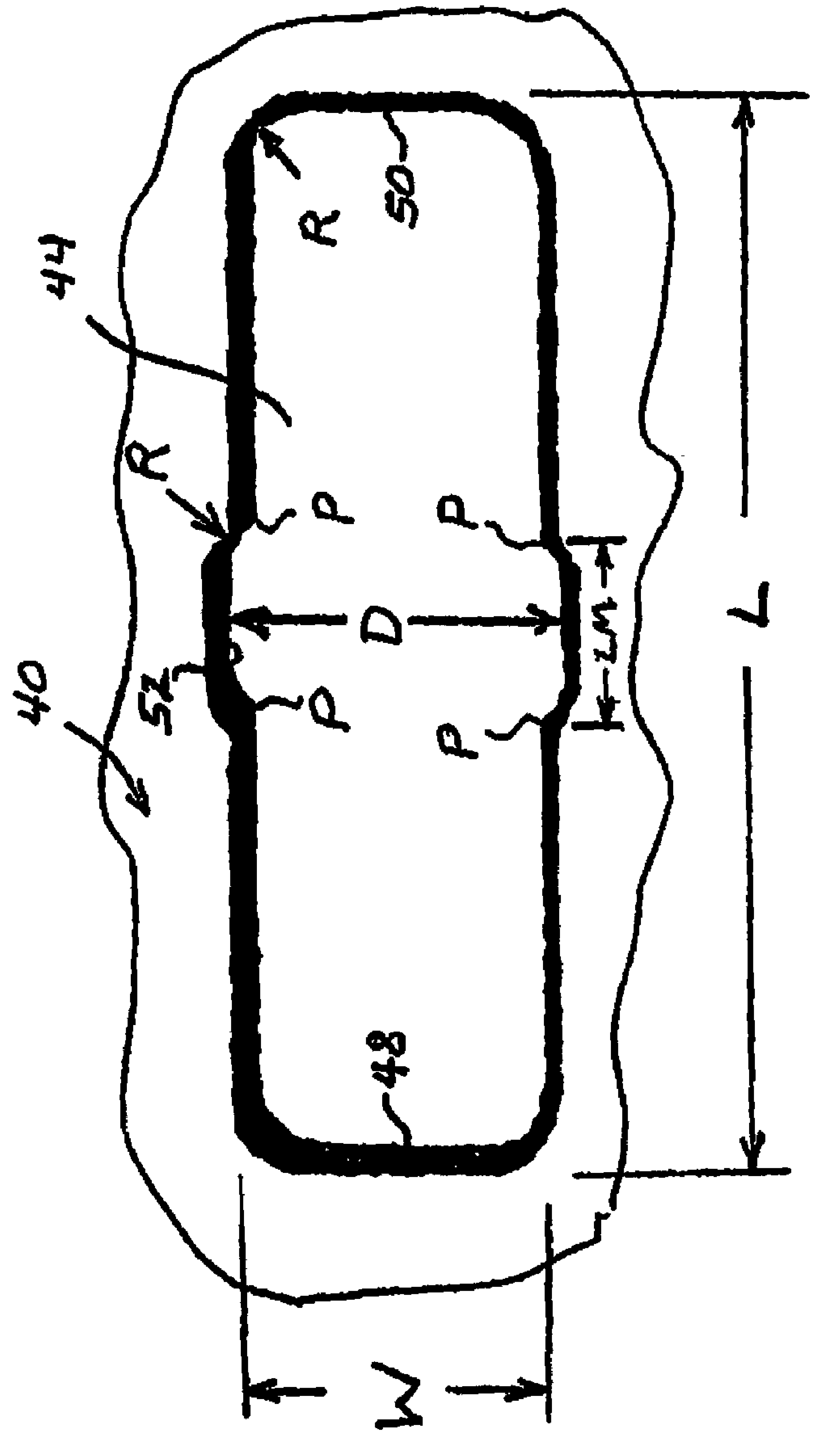

FIG. 25

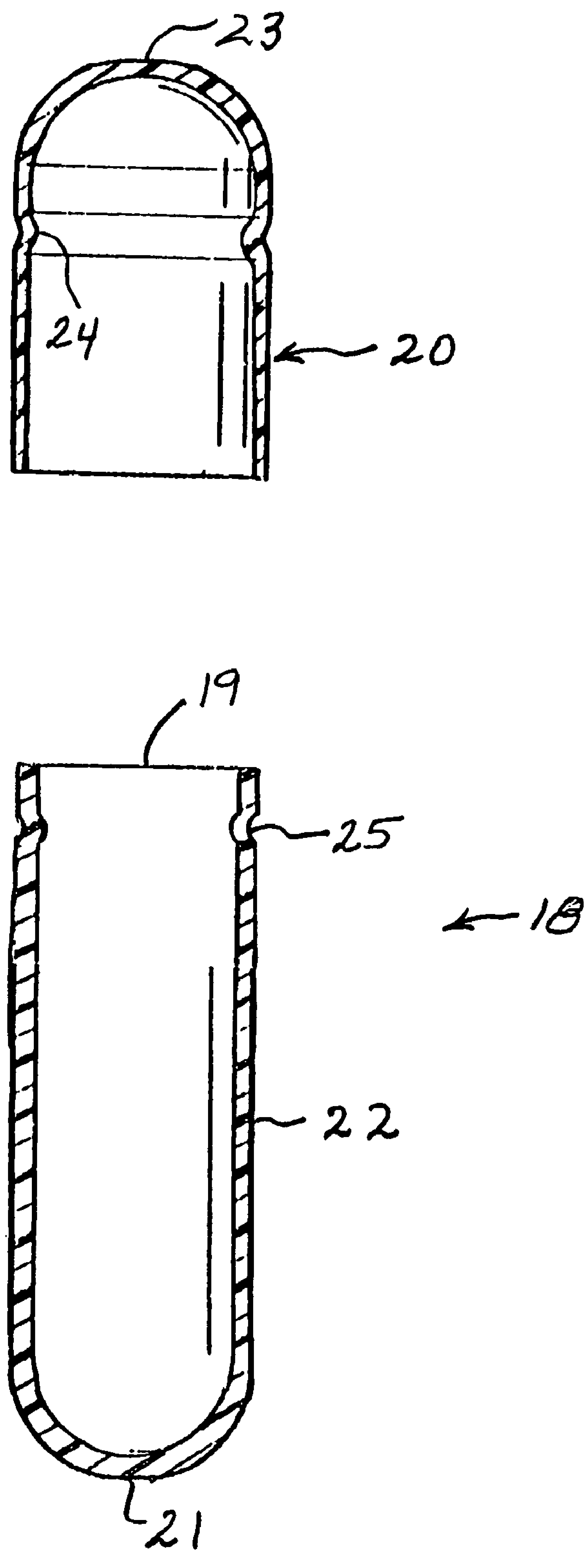

FIG. 26

FIG. 27

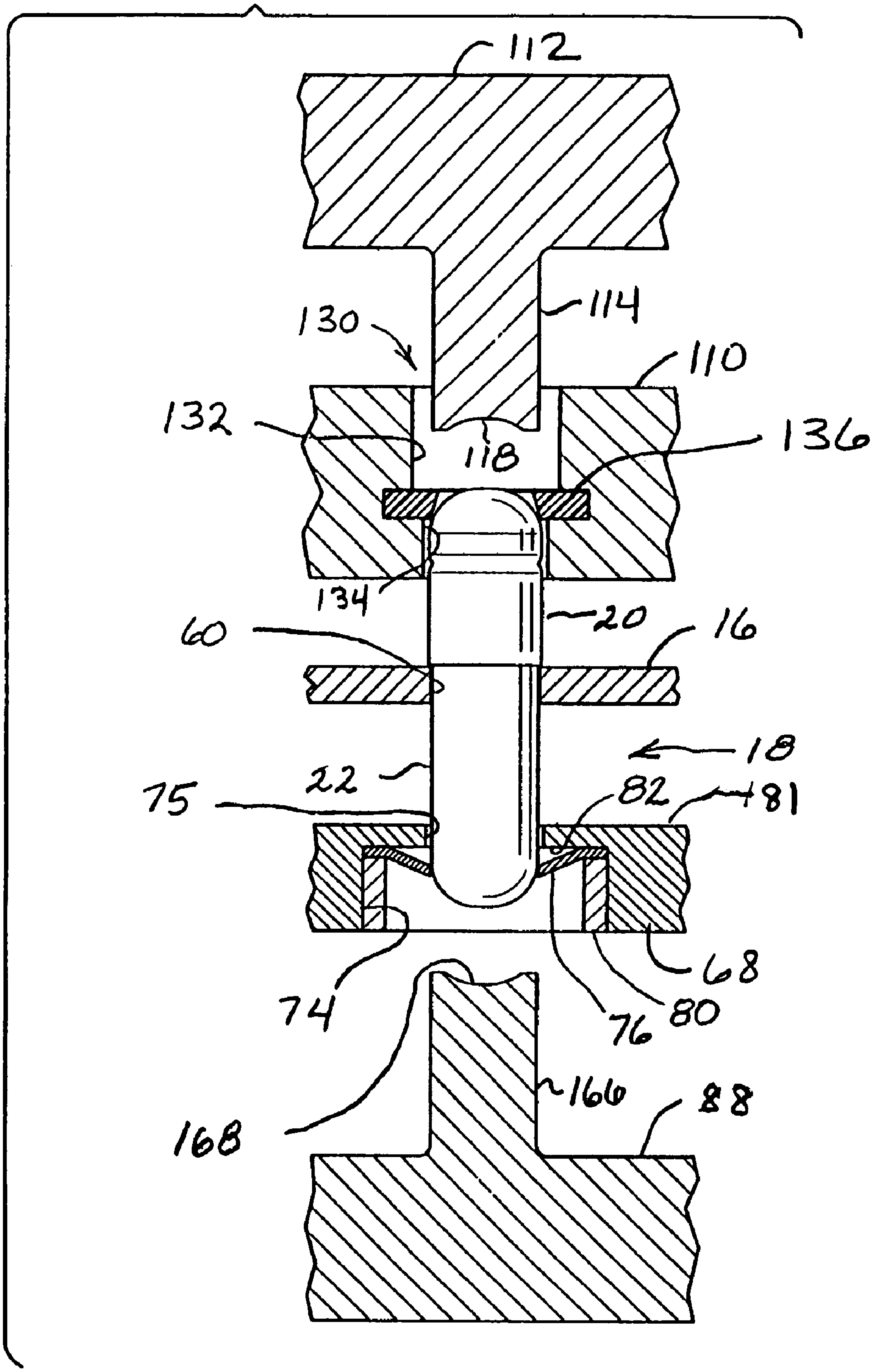
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FIG. 28

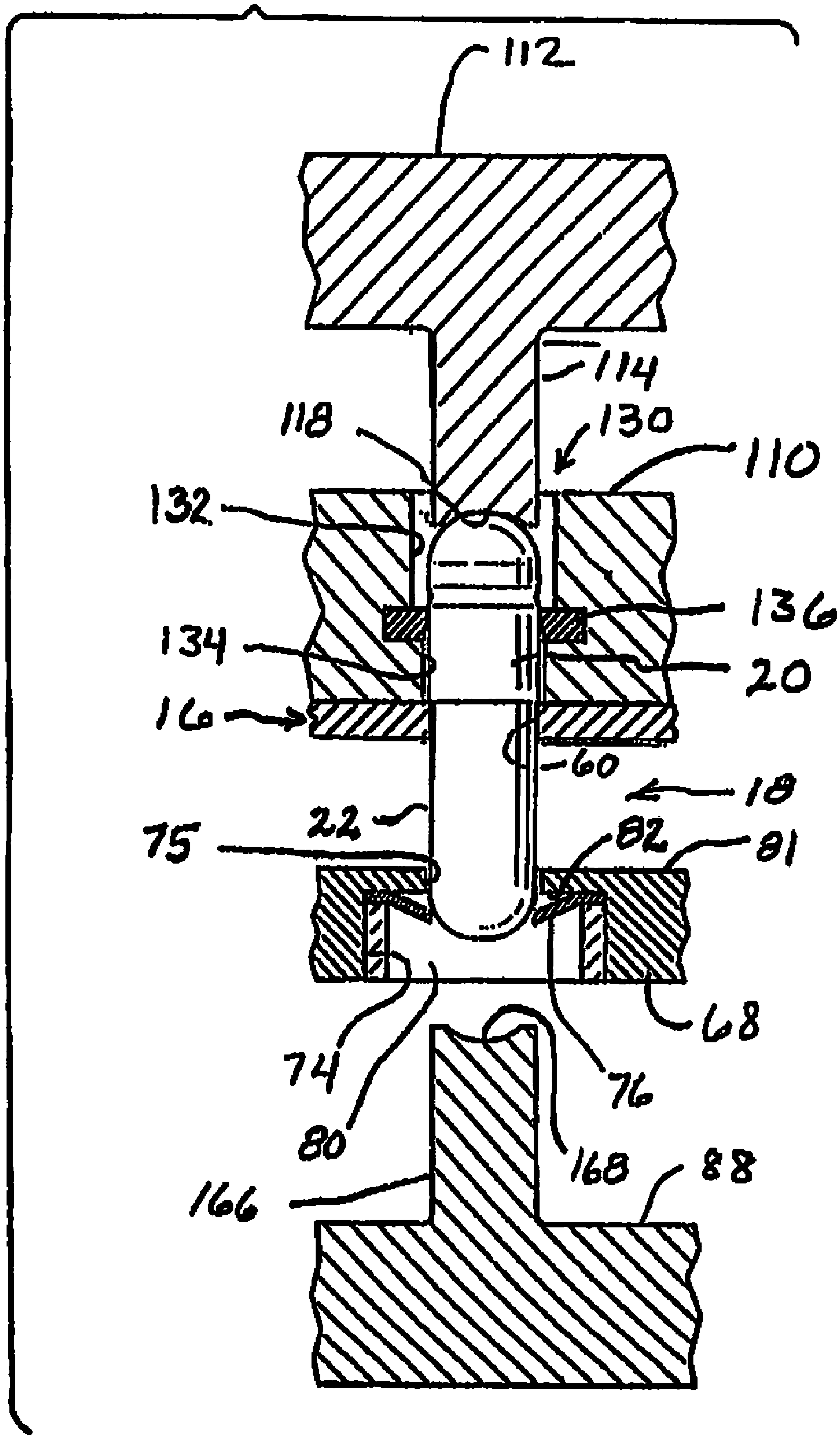
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FIG. 29

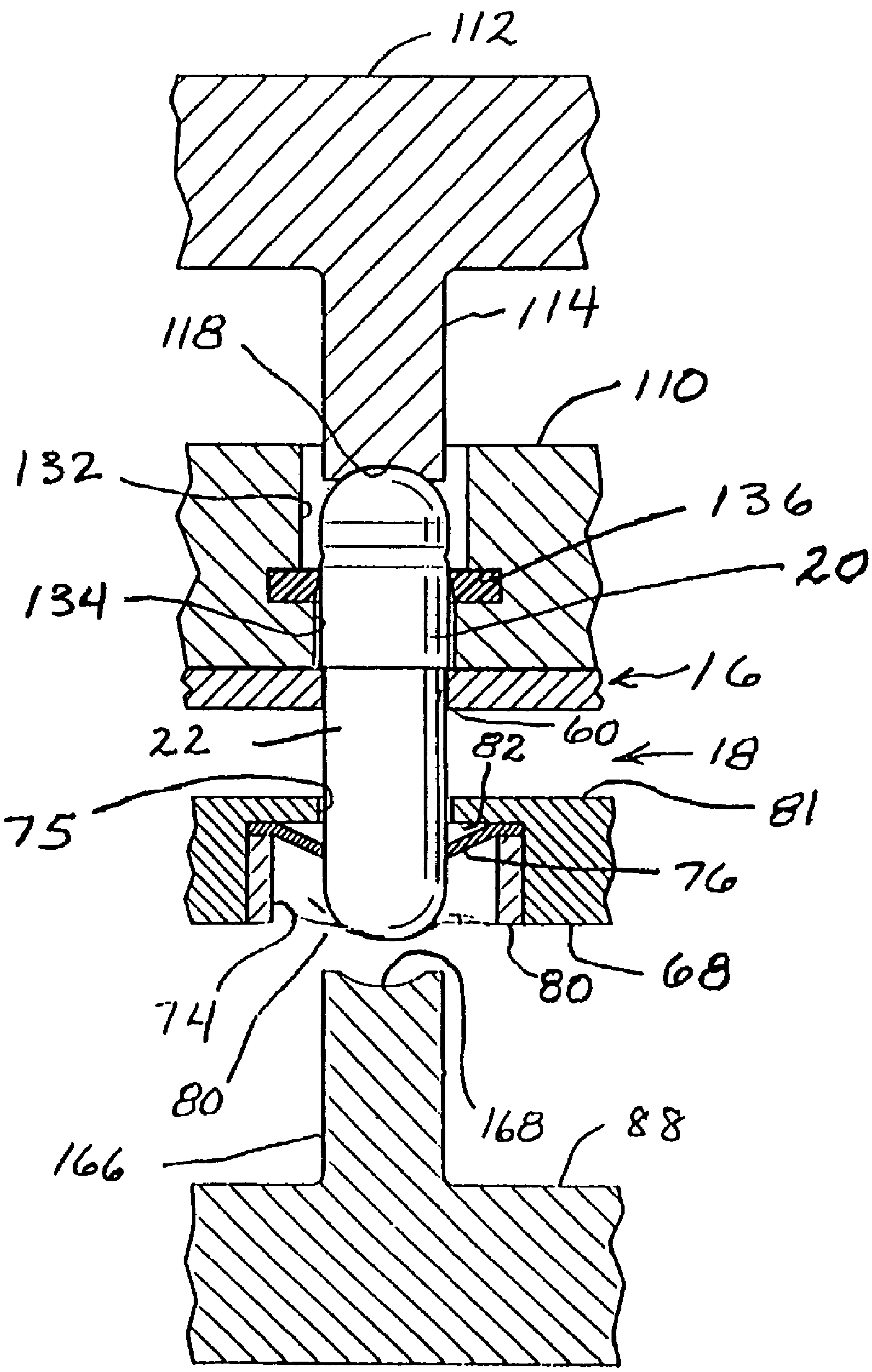
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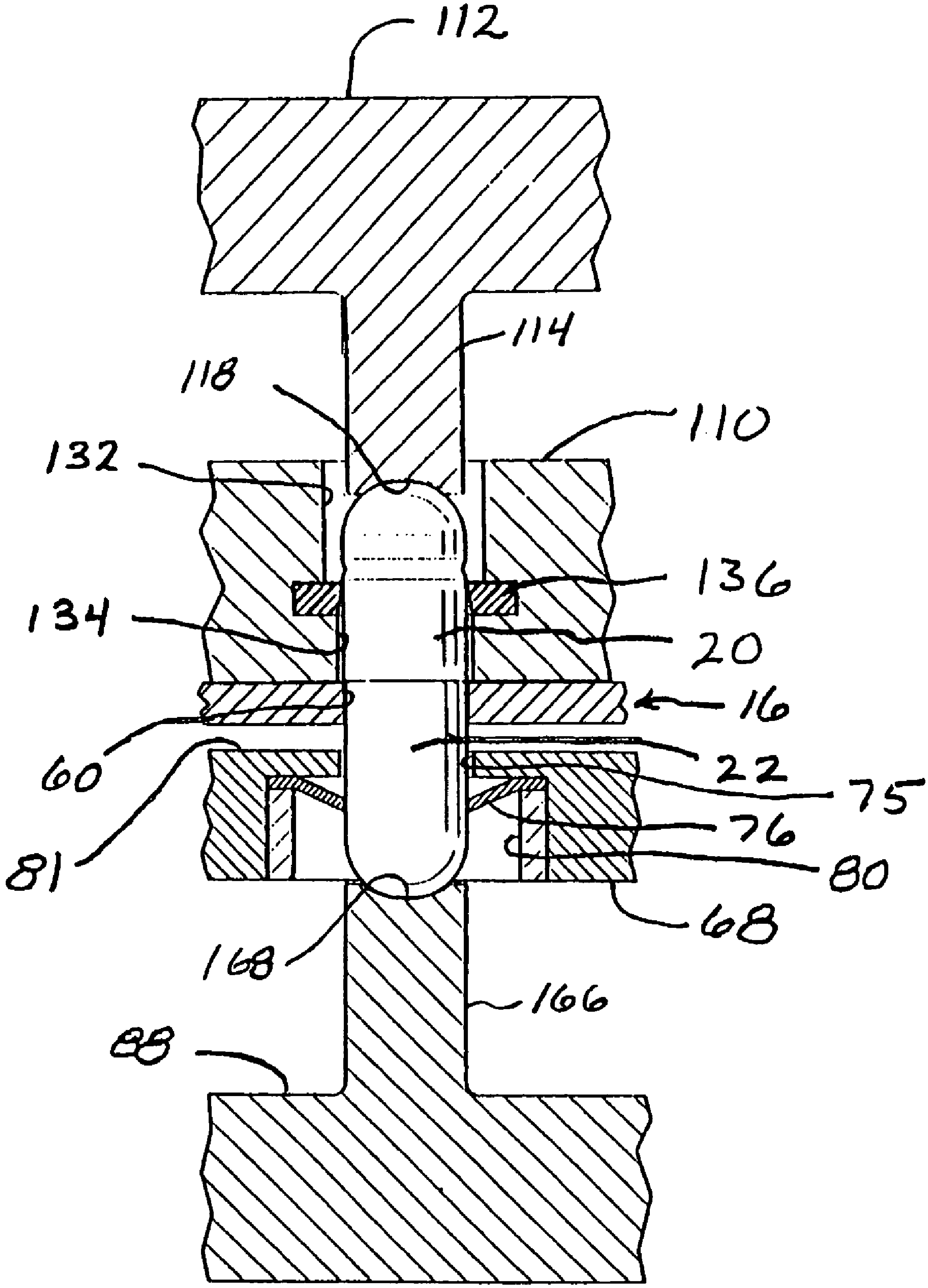
FIG. 30



MANUAL CAPSULE LOADING MACHINE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a divisional application of and claims the benefit of U.S. patent application Ser. No. 11/297,239, filed on Dec. 9, 2005, which has issued as U.S. Pat. No. 7,337,596 B2, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a machine useful for concurrently aligning a multiplicity of capsule shells in preparation for separation of the capsule caps from the capsule bodies, concurrent removal of the capsule caps from the capsule bodies, and concurrent replacement and sealing of the capsule caps on the capsule bodies once the capsule bodies have been filled with the desired substance.

2. Description of the Prior Art

Many different medications and vitamin and mineral supplements are orally administered in the form of gel capsules that dissolve in the human body once ingested. Gel capsules are manufactured in several standardized sizes and include capsule shells, each comprised of a capsule cap that slides onto the end of a capsule body. Conventional capsule shells are oblong in shape, having rounded ends, and vary in size from a small fraction of an inch to slightly over an inch in length. Both the caps and the cylindrical bodies of conventional gel capsule shells have a circular, annular cross section.

During the manufacture of the capsule shell components the walls of each capsule body are deformed by creating a shallow, annular, radial groove in the outer wall surface a short distance from the open, circular mouth of the capsule body. The capsule caps are each deformed to create a mating, radially inwardly projecting ring on their inner wall surfaces near their closed extremities. As shipped, the capsule shells are still separable so that they can be filled with a medical composition, vitamins, and/or minerals with the cap of each capsule shell telescopically fitted onto the mouth of the capsule body so that the capsule shell is provided in the form of a closed unit.

As provided by capsule shell manufacturers, the capsule cap is telescopically fitted onto the capsule body to only a limited extent, so that a longitudinal gap exists between the radially inwardly projecting ring on the inner wall of the capsule cap and the corresponding radial groove formed in the outer wall of the capsule body. Consequently, the capsule cap can be easily separated from the capsule body in order for the capsule body to be filled with the desired substance.

Once the medication or other powdered, granular, or liquid material has been placed in the capsule bodies, the caps of the capsule shells are concurrently replaced on to the open mouths of the capsule body shells. The caps and the bodies are then concurrently pressed toward each other a sufficient distance so that the annular, radially inwardly protruding ring on each capsule cap engages the outwardly facing annular groove on the outer wall of a capsule body. The capsule caps are thereupon inextricably sealed onto the capsule bodies.

Very sophisticated, expensive capsule shell manipulation machines exist for the mass production of capsules containing medication, vitamins, minerals, and other substances. Such machines are described, for example, in U.S. Pat. Nos. 5,081,822; 4,884,602; 4,964,262; 4,731,979; 4,761,932; and 5,074,102. The prior art machines depicted in these patents are exemplary only, as numerous other devices exist for the

mass production of filled capsules. However, the foregoing devices share a common characteristic of very substantial expense in capital equipment for the machinery required and constant monitoring. The cost of such conventional systems can be justified only where extremely high volumes of capsules are involved.

There exists, however, a need for machinery for manipulating smaller batches of capsules, as well as the continuous mass production of capsules. That is, a need exists for much lower cost equipment than conventional capsule filing machinery in order to concurrently separate capsule caps from capsule bodies, fill the capsule bodies, and replace and seal the capsule caps on the filled capsule bodies in volumes on the order of about one hundred capsules at a time. It would be highly desirable to use low cost, manually operated equipment, rather than the expensive, automated, continuously operating equipment that is available for the mass production of capsules.

Some devices do exist for this purpose. For example, Tashi Enterprises located at 5221 Central Avenue, No. 105, Richmond, Calif. 94804, has distributed a capsule loader, model CH 100-00 utilized for orienting the capsule components and separating the capsule caps from the capsule bodies, and a model M 100-00GM capsule filler for sealing the capsule bodies. This equipment is intended to provide advantages over manual separation of capsule caps and bodies and replacing the capsule caps and sealing them to the capsule bodies once the capsules are filled. However, due to its design, this equipment is to some extent unreliable and requires considerable operator skill to prevent the capsules from being damaged during manufacture. Also, it is subject to improper capsule shell component orientation due to the effects of static electrical charges upon the capsule shell components.

SUMMARY OF THE INVENTION

The present invention provides a unique, economical, and easily operable device for orienting, loading, and sealing batches of capsules. The capsule orienting mechanism of the present invention is extremely reliable and easy to operate. Utilizing the orientation mechanism of the invention, capsule shells are quickly and easily aligned in a matrix with all capsules aligned upright in the same vertical orientation with the capsule caps located atop the capsule bodies.

Unlike prior systems, removal of the capsule caps is accomplished with the application of a uniform force each time, and is not subject to variations in forces exerted on the capsule components due to the application of different forces by the same or different operators. Furthermore, once the capsule bodies have been filled, the same mechanism is employed to replace the capsule caps on the bodies and seal the filled capsule shell components together, again without variations in force and without damage to the capsules.

One primary object of the present invention is to provide a capsule filling machine that can be used to manipulate the components of capsule shells for filling and sealing in batches using equipment that is far less expensive than equipment employed in the mass production of capsules.

Another object of the invention is to provide a manually operated capsule orienting, cap removal, and cap sealing mechanism that performs consistently without misalignment of capsule shells or damage to the capsule shells or their component members during filling and sealing of the capsule shells.

A further object of the invention is to provide a capsule shell manipulation device that can be easily operated and which is not susceptible to variations in the forces applied to the capsule components due to differences in manually applied forces by the machine operator.

Hard gelatin capsule shells, sometimes termed dry filled capsules, are formed in two sections. Specifically, hard gelatin capsule shells have a cap with an open mouth and a rounded closed end and a circular, annular cross section that slips over the open mouth of a capsule shell body that is longer than the cap and also has a rounded, closed end. Companies having equipment for manufacturing empty hard gelatin capsule shells include Eli Lilly, Parke-Davis, Schering-Plough, and SmithKline. Hard gelatin capsules are manufactured, for the most part, in eight different sizes which are designed as follows: 000; 00; 0; 1; 2; 3; 4; and 5, listed here in descending order of size.

In one broad aspect the present invention may be considered to be a manually operated apparatus for uniformly orienting a multiplicity of oblong capsule shells of circular cross section, each having a cap fitted telescopically onto a smaller diameter body. The apparatus is comprised of an upper alignment plate, a capsule rectifying plate, a funnel tray, and a capsule receiving tray.

The upper alignment plate forms a capsule orienting tray and defines a matrix of uniformly aligned, oblong capsule receiving cradles each having an oblong horizontal capsule drop slot defined therethrough. Each of the capsule drop slots has a length and width sufficient to permit passage of the capsules therethrough while they are in a horizontal disposition. The capsule rectifying plate is located directly beneath and parallel to the upper alignment plate. The capsule rectifying plate has horizontal capsule rectifying apertures defined therein corresponding to, parallel to, and shaped lengthwise as the capsule drop slots. However, the opposing ends of the capsule rectifying apertures are wider than the capsule bodies and narrower than the capsule caps. The capsule rectifying apertures have midsections that are wider than the capsule caps. The ratio of the length of the midsections to the entire length of the capsule rectifying apertures is between about 0.15 and about 0.20 to one.

The funnel tray is located beneath the capsule rectifying plate. The funnel tray includes funnels located beneath the drop apertures and the rectifying apertures. The funnel tray has circular funnel discharge apertures large enough to provide clearance for the passage of the capsules therethrough while in a vertical orientation. The capsule receiving tray has circular capsule receiving apertures defined therein and located directly beneath the funnel discharge apertures.

A selected one of the upper alignment and capsule rectifying plates is mounted in laterally reciprocal fashion relative to the other of these plates. The reciprocally mounted plate is movable alternatively between a capsule discharge position and a capsule orienting position. In the capsule discharge position the capsule rectifying apertures reside in vertical registration with the capsule drop slots. In the capsule orienting position, the capsule rectifying apertures are at least partly laterally offset from the capsule drop slots.

Preferably, the ratio of the length of the midsections to the entire length of the capsule rectifying apertures is about 0.1836 to one. Where the capsules to be processed are of the size designation 00, each of the midsections is about 0.179 inches in length and the entire length of each of the capsule rectifying apertures is about 0.975 inches in length.

Either the upper alignment plate or the capsule rectifying plate, but not both, are secured permanently in position relative to the funnel tray. In the preferred embodiment of the invention the upper alignment plate is rigidly secured to the funnel tray and the capsule rectifying plate is mounted for reciprocal movement therebetween. Alternatively, the capsule rectifying plate could be rigidly secured to the funnel tray, while the upper alignment plate could be mounted for reciprocal movement above and relative to the capsule rectifying plate.

In embodiments in which the capsule rectifying plate is the movable, reciprocal member, at least one, and preferably a pair of horizontally oriented coil springs are provide to act between the upper alignment plate and the capsule rectifying plate. These horizontal springs bias the capsule rectifying plate toward the capsule orienting position in which the capsule rectifying apertures are at least partially laterally offset from the capsule drop slots.

The capsule receiving apertures in the capsule receiving tray each have a diameter larger than the diameter of the capsule bodies, but smaller than the diameter of the capsule caps. The capsule receiving apertures are arranged in corresponding vertical alignment with the funnels. The capsule receiving tray may also form a portion of a capsule separation assembly. The upper alignment plate, the capsule rectifying plate, and the funnel tray are preferably assembled together as a capsule orientating unit. The capsule orienting unit is removably positionable directly upon the capsule receiving tray.

In another broad aspect the invention may be considered to be a manually operated machine for separating a multiplicity of capsule shells having an oblong shape and capsule caps that fit telescopically onto smaller diameter capsule bodies. The machine is comprised of a capsule receiving tray, a capsule body retention tray, a framework, a capsule cap retention tray, vertical biasing springs, and a lever mechanism.

The capsule receiving tray has circular capsule receiving apertures that are of a diameter large enough to permit passage of the capsule bodies therethrough and smaller in diameter than the capsule caps. The capsule body retention tray is located directly beneath the capsule receiving tray. The capsule body retention tray has capsule body retaining openings with capsule body gripping rings therein that exert less frictional force against movement of the capsule bodies through the capsule body retaining openings in a direction away from the capsule receiving tray than toward the capsule receiving tray.

The framework carries the capsule receiving tray and joins it to the capsule body retention tray in an orientation parallel thereto. The framework is constructed to permit movement of the capsule receiving tray toward the capsule body retention tray.

The capsule cap retention tray is located directly atop the capsule receiving tray and has capsule cap receiving apertures therein. The capsule cap receiving apertures are equipped with capsule cap grasping rings that exert less frictional force against movement of the capsule caps therethrough in a direction away from the capsule receiving tray than in a direction toward the capsule receiving tray.

The vertical biasing springs act between the capsule receiving tray and the capsule body retention tray to urge them apart from each other. The vertical springs urge the capsule receiving tray upwardly and away from the capsule body retention tray. The lever mechanism is joined to the framework and is operable against the force of the vertical biasing springs to entrap the cap retention tray directly atop and in face-to-face contact with the capsule receiving tray. The lever mechanism is also operable to press the capsule cap retention tray and the capsule receiving tray together toward the capsule body retention tray by collapsing the tray support linkage.

The machine of the invention is preferably provided with releaseable latches for holding the framework in a collapsed condition. It is also preferably provided with a capsule sealing plate having a multiplicity of upwardly projecting capsule body engaging posts aligned with the capsule body retaining openings. The framework supports the capsule sealing plate parallel to and beneath the capsule body retention plate. Sealing lever linkages are mounted on the framework and are engageable by the lever mechanism to raise the capsule sealing plate upwardly. This action pushes the capsule bodies upwardly toward the capsule cap retention tray. The lever mechanism has lever arms that are counterrotatable against the sealing lever linkages to raise the capsule sealing plate sufficiently to permanently seal the capsule caps and the capsule bodies together.

Preferably the capsule body gripping rings in the capsule retaining openings are formed as resilient, thin, circular, annular wafers of metal having central cruciform openings defined therein with capsule body retaining flanges between the arms of the cruciform openings. The capsule body retaining flanges are preferably directed at an inclination away from the capsule receiving tray. The capsule cap grasping rings are preferably each formed as a resilient, circular, annular structure.

In still another broad aspect the invention may be considered to be a method of separating a multiplicity of oblong capsule shells wherein the capsule shells include capsule caps frictionally fitted telescopically onto smaller diameter capsule bodies in a separable state, and thereafter permanently attaching the caps to the bodies in a sealed state. The invention is comprised of the steps of dropping the capsule shells in a separable state into a capsule receiving tray, positioning a capsule body retention tray directly beneath the capsule receiving tray, positioning a capsule cap retention tray directly atop the capsule receiving tray, pressing the capsule cap retention tray and the capsule receiving tray together towards the capsule body retention tray, and removing the capsule cap retention tray from the capsule receiving tray.

The capsule receiving tray has a matrix of circular capsule receiving apertures defined therein. These capsule receiving apertures are of a diameter large enough to permit passage of the capsule bodies therethrough and smaller in diameter than the capsule caps. The capsules are dropped into the capsule receiving tray in a manner such that each of the capsules is oriented with its capsule cap located vertically atop its capsule body. Each capsule resides in a separate one of the capsule receiving apertures. The capsule receiving tray laterally immobilizes the capsule bodies and supports the capsule caps from beneath at the capsule receiving apertures.

Each of the capsule bodies is located directly above a separate capsule retaining aperture in the capsule body retention tray. Each capsule retaining aperture contains a capsule body gripping ring. The capsule body gripping rings exert less frictional force against movement of the capsule bodies therethrough in a direction away from the capsule receiving tray than in a direction toward the capsule receiving tray.

The capsule cap retention tray is positioned directly atop the capsule receiving tray. The capsule cap receiving tray has capsule cap receiving apertures therein equipped with capsule cap grasping rings. These grasping rings exert less frictional force against movement of the capsule cap therethrough in a direction away from the capsule receiving tray than in a direction toward the capsule receiving tray. When the capsule retention tray is placed atop of the capsule receiving tray, the capsule caps are advanced into the capsule cap grasping rings, which thereupon engage the capsule caps.

As the capsule cap retention tray and the capsule receiving tray are pressed together toward the capsule body retention tray, the capsule bodies are advanced into the capsule body gripping rings. Therefore, when the capsule cap retention tray is then removed from the capsule receiving tray, the capsule bodies remain lodged in the capsule body gripping rings while the capsule caps remain lodged within the capsule cap grasping rings. Removal of the capsule cap retention tray from the capsule receiving tray thereby concurrently separates the capsule caps from the capsule bodies.

In a preferred implementation of the method of the invention the capsule caps are replaced onto the capsule bodies and sealed thereto once the capsule bodies have been loaded with the desired substance. This is done by replacing the capsule cap retention tray atop the capsule receiving tray and again pressing the capsule cap retention tray and the capsule receiving tray together toward the capsule body retention tray to thereby concurrently replace the capsule caps back on the capsule bodies. Then the capsule bodies are forced upwardly and toward the capsule cap retention tray while concurrently applying an opposing force against the capsule caps. The exertion of this force replaces the capsule caps on the capsule bodies and permanently engages the capsule caps on the capsule bodies. This force is preferably applied by raising a capsule sealing plate having a multiplicity of capsule engaging posts that force the capsule bodies upwardly within the capsule retaining apertures.

The invention may be described with greater clarity and particularity by reference to the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view illustrating a capsule orientating unit positioned above a portion of a capsule separation assembly according to the invention.

FIG. **2** is a side elevational view of the capsule orienting unit shown in FIG. **1**.

FIG. **3** is a sectional detail taken along the lines **3**-**3** in FIG. **2** showing a top plan view of the funnel tray of the capsule orienting unit of FIG. **2**.

FIG. **4** is a top plan view of the capsule rectifying plate employed in the capsule orienting unit of FIG. **2**, shown in isolation.

FIG. **5** is a top-plan view of the capsule orienting unit of FIG. **2** with the capsule rectifying plate shown in the capsule orienting position.

FIG. **6** is a top plan view of the capsule orienting unit of FIG. **2** with the capsule rectifying plate shown in the capsule discharge position.

FIG. **7** is a sectional elevational view of the capsule orienting apparatus of the invention, taken along the lines **7**-**7** in FIG. **5**, shown with capsules loaded on the upper alignment plate and with the capsule rectifying plate in the capsule orienting position.

FIG. **8** illustrates the apparatus of FIG. **7** as the capsule rectifying plate is moved to the capsule discharge position.

FIG. **9** illustrates the manner of descent of the capsules through the funnel plate and into the capsule receiving tray.

FIG. **10** is an exploded perspective view of the capsule separation assembly of the invention showing the capsule top lift assembly thereof removed from atop the capsule receiving tray.

FIG. **11** is a bottom plan view of the capsule cap sealing plate of the capsule top lift assembly of the invention, shown in isolation.

FIG. **12** is an exploded sectional elevational view of the capsule top lift assembly shown in FIG. **10**.

FIG. **13** is a top plan view of the capsule separation assembly shown with the capsule lift assembly in position prior to separation of the capsule caps from the capsule bodies.

FIG. **14** is a detail elevational view showing in isolation one of the guide pins employed in the capsule separation assembly of the invention.

FIG. **15** is a front perspective view of the capsule separation assembly illustrating the capsule top lift assembly being forced toward the capsule body retention tray.

FIG. **16** is an elevational detail of one end of the capsule separation assembly, partially broken away.

FIG. **17** is a sectional elevational view of a single one of the capsule body gripping rings, shown in isolation.

FIG. **18** is a top plan view of a single one of the capsule body gripping rings.

FIG. **19** is a top plan view of the capsule receiving tray of the invention.

FIG. **20** is a bottom plan view of the tamping plate of the invention.

FIG. **21** is a side elevational view of the tamping plate of the invention.

FIG. **22** is a front perspective view showing the capsule separation assembly in the condition depicted in FIG. **13**.

FIG. **23** is a top plan view of the capsule separation assembly of FIG. **13**, but with the latching pins engaged.

FIG. **24** is a front perspective view illustrating counterrotation of the levers and raising of the capsule sealing plate of the invention.

FIG. **25** is a plan detail illustrating a single one of the capsule rectifying apertures in the capsule rectifying plate of FIG. **4**.

FIG. **26** is an exploded sectional elevational view of a single one of the capsule shells.

FIG. **27** is an enlarged sectional elevational view of a single capsule shell in the capsule separation assembly of the invention shown as the capsule top lift assembly first approaches the capsule receiving tray.

FIG. **28** is an enlarged sectional elevational view of a single capsule shell in the capsule separation assembly of the invention shown with the top lift assembly resting on the capsule receiving tray.

FIG. **29** is an enlarged sectional elevational view of a single capsule shell in the capsule separation assembly of the invention shown with the top lift assembly and capsule receiving tray being pressed toward the capsule body retention tray.

FIG. **30** is an enlarged sectional elevational view of a single capsule shell in the capsule separation assembly of the invention shown with the top lift assembly and capsule receiving tray being pressed toward the capsule body retention tray and with the capsule sealing plate being forced upwardly toward the capsule body retention tray.

DESCRIPTION OF THE EMBODIMENT

FIG. **1** illustrates major components of a preferred embodiment of the manual capsule loading machine according to the invention. As shown in FIG. **1** the capsule loading machine includes a capsule orienting unit indicated generally at **12** and the lower portion of a capsule separation assembly indicated generally at **14**. The capsule orienting unit **12** is removably positionable directly upon a capsule receiving tray **16**, which forms a part of both an apparatus for uniformly orienting a multiplicity of oblong capsule shells **18** and also the lower portion of the capsule separation assembly **14**. The capsule shells **18** are best illustrated in FIGS. **26-30**.

As shown in FIG. **26**, for example, each of the capsule shells **18** is an oblong structure of circular cross section. Each capsule shell **18** has a cap **20** that is fitted telescopically onto a smaller diameter body **22**.

The capsule shells **18** may be any one of the standard sizes of gelatin capsules ranging from the largest designated “000” to the smallest designated as “5”. The capsule orienting unit **12** and the capsule separation assembly must be constructed so as to accommodate capsule shells **18** of a particular one of these sizes. In the embodiment illustrated the manual capsule loading machine shown is designed to concurrently orient, separate, and load capsule shells having the size designation “0”.

FIG. **26** is an exploded, sectional, elevational view illustrating a single capsule shell **18** with its cap **20** separated from its body **22**. The bottom end **21** of the capsule body **22** is rounded into a hemispherical configuration, while the opposite upper end **19** of the body **22** surrounds an open, circular mouth. The lower end of the capsule cap **20** also surrounds an open circular mouth that fits telescopically about the upper end **19** of the capsule body **22**.

As shown in FIG. **26** the cap **20** is slightly deformed proximate its hemispherical top end **23** with an annular, radially inwardly projecting rib **24** that extends about the entire interior perimeter wall of the cap **20**. Near its open mouth the capsule body **22** is slightly deformed so that an annular, radially inwardly directed groove or channel **25** is defined in the outer wall surface of the capsule body **22**.

The capsule shells **18** are provided for filling with the capsule caps **20** telescopically engaged on the capsule bodies **22**, but with a longitudinal separation existing between the radially inwardly projecting rib **24** on the inner wall of the capsule cap **20** and the radially inwardly directed groove **25** in the outer wall of the capsule body **22**. Consequently, the capsule cap **20** can be separated from the capsule body **22** by pulling these two capsule components longitudinally apart from each other.

The capsule shells **18** are supplied for filling in a separable state in which the open end **19** of the capsule body **22** resides just short of the lip **24** of the capsule cap **20**. When the capsule cap **20** and the capsule body **22** are engaged in their separable state, the cap **20** can be removed from the capsule body **22** by pulling the capsule body **22** and the capsule cap **20** axially apart from each other.

Once the capsule shell **18** has been loaded with the desired substance, the capsule cap **20** is again telescopically engaged upon the capsule body **22** and forced axially toward the rounded lower end **21** thereof until the annular rib **24** in the inner wall of the capsule cap **20** engages the annular groove **25** in the outer wall of the capsule body **22**. Once the rib **24** engages the groove **25**, the capsule shell **18** is in a sealed condition and the capsule cap **20** an capsule body **22** can no longer be separated from each other due to the interengagement of the rib **24** in the groove **25**. The capsule shell **18** is thereupon permanently sealed.

The capsule orienting unit **12** and its component parts are illustrated in FIGS. **1-9**. The capsule orienting unit **12** is comprised of an upper alignment plate **30** defining a matrix of uniformly aligned capsule-receiving cradles **32**, each having an oblong, horizontal capsule drop slot **34** defined therethrough. Each of the capsule drop slots **34** has a length and width just sufficient to permit passage of the capsule shells **18** in their telescopically engaged separable states, and while in a horizontal disposition.

The capsule receiving tray **16** forms a part of the capsule separation assembly, although it is not part of the capsule orienting unit **12**. Rather, the upper alignment plate **30**, the capsule rectifying plate **40**, and the funnel tray **42** are assembled together to form the capsule orienting unit **12**. The capsule orienting unit **12** is removably positionable directly atop the capsule receiving tray **16**, as illustrated in FIG. **1**.

The upper alignment plate **30** forms a shallow tray having a floor **31** surrounded by an inclined retaining wall **33**. The upper alignment plate **30** forms a capsule orienting tray that defines a rectilinear matrix of oblong, horizontal capsule drop slots **34** at the bottoms of the cradles **32**. The capsule drop slots **34** have the same shape as a capsule shell **18** and are just slightly larger than a capsule shell **18** when the capsule shells **18** are in their separable condition. In the embodiment of the invention illustrated, there are fifty different capsule-receiving cradles **32** defined in the floor **31** of the upper alignment plate **30**. The capsule-receiving cradles **32** are arranged in a five by ten matrix array and are all aligned in a common direction, as illustration in FIGS. **5** and **6**.

The peripheral, horizontal rim **29** of the upper alignment plate **30** resides at a distance of 0.75 inches above the level of the floor **31**. The containment walls **33** of the upper alignment plate **30** are inclined at an angle of forty-five degrees and the corners of the tray formed by the upper alignment plate **30** are rounded, not square.

The individual capsule drop slots **34** are radiused all around. The floor **31** is 0.300 inches in thickness. The thickness of the floor **31** is such that the depth of the capsule drop slots is sufficient to discourage disoriented capsules from "jumping out" of the capsule retaining cradles **32**.

The length of each of the capsule drop slots **34** is tightly controlled and just greater than the length of the capsule shells **18** when they are in a separable condition. It is therefore possible to perform a visual inspection of the capsule shells **18** residing in the matrix of horizontal capsule drop slots **34** prior to discharging the capsule shells **18** through the capsule rectifying apertures **44**. A visual inspection of the capsules is useful, since some capsules arrive in a sealed condition, rather than in a separable condition. If the capsules are in a sealed condition, the gap between one or both ends of the capsule and the extremities of the capsule drop slot **34** in which such a capsule resides will be noticeable. Consequently, such prematurely sealed capsules can be removed and replaced with capsules which are in the separable condition prior to moving the capsule rectifying plate **40**. Also, some of the capsules arrive with caps on both ends of the capsule bodies. With a visual inspection the cap on the closed, rounded end of the capsule body can be removed.

Each of the oblong, horizontal capsule drop slots **34** defined in the floor **31** of the capsule alignment plate **30** has a length and width just sufficiently large enough to permit passage of the capsule shells **18** therethrough while in a horizontal disposition and in a separable state. The upper alignment plate **30** is provided with corner flanges **36** and center flanges **38** on its opposite sides extending away from each other in a direction perpendicular to the orientation of the capsule drop slots **34**.

The capsule orienting unit **12** is further comprised of a capsule rectifying plate **40**, shown in isolation in FIG. **4**, and a funnel tray **42** shown in a top plan view in FIG. **3**, and also visible in FIGS. **7**, **8**, and **9**. The capsule rectifying plate **40** is located directly beneath and parallel to the upper alignment plate **30** and has horizontal capsule rectifying apertures **44** defined therein. The capsule rectifying apertures **44** correspond to, are parallel to, and are shaped lengthwise the same as the capsule drop slots **34**.

The capsule rectifying apertures **44** have opposing ends **48** and **50** that are wider than the capsule bodies **22** and narrower than the capsule caps **20**. The capsule rectifying apertures **44** also each have a midsection **52** that is wider than the capsule caps **20**. The ratio of the length of the midsections **52** to the entire length of the capsule rectifying apertures **44**, as measured longitudinally between the opposing ends **48** and **50** thereof, is between 0.15 and about 0.20 to one in the embodiment of the invention illustrated.

The relative dimensions of the capsule rectifying apertures **44** are critical to the capsule rectifying function of the invention and must be closely matched to the particular size capsule utilized. FIG. **25** is an enlarged, detail view of a small area of the capsule rectifying plate **40** showing a single one of the capsule rectifying apertures **44**.

Each capsule rectifying aperture **44** formed in the capsule rectifying plate **40** is dimensioned for use in rectifying the orientation of "0" size capsules. Specifically, each of the capsule rectifying apertures **44** has an overall length indicated at L equal to 0.975 inches and an overall width W equal to 0.288 inches+/−0.001 inches at the opposing ends **48** and **50**. The midsection **52** of each capsule rectifying aperture **44** must be between about fifteen percent and twenty percent of the overall length L of the capsule rectifying aperture **44**.

In the embodiment illustrated each of the midsections **52** has a length LM that is about 0.1836 of the overall length L of the capsule rectifying aperture **44**. The length LM is preferably 0.179 inches in length, measured between the points P where the radii of curvature R of the midsections **52** intersect the longitudinal linear sides of the ends **48** and **50**. The distance between the edges of the capsule rectifying apertures **44** measured at the midsections **52** thereof is indicated as a distance D in FIG. **25**. In the embodiment of the invention illustrated the distance D is equal to 0.318 inches+/−0.001 inches. The transitions between the midsections **52** and the ends **48** and **50** of the capsule rectifying apertures **44** have a radius of curvature R equal to 0.093 inches. The radius of curvature of the corners of each capsule rectifying aperture **44** at the ends **48** and **50** thereof is likewise a radius of curvature R equal to 0.093 inches.

The pivot points P indicated in FIG. **25** must be close to the center of gravity of the capsule shell **18**, which is within the capsule body **22** but quite near the intersection of the capsule cap **20** with the capsule body **22** when the capsule shell **18** is in the separable condition. The determining factor for the minimum length LM of the midsections **52** of the capsule rectifying apertures **44** is determined by the diameter of the capsule cap **20** itself.

The funnel tray **42** is illustrated in FIG. **3** and is located directly beneath the capsule rectifying plate **40**. The funnel tray **42** defines a total of fifty funnels **54** located beneath the drop slots **34** of the upper alignment plate **30** and beneath the rectifying apertures **44** of the capsule rectifying plate **40** when the capsule rectifying plate **40** is moved so that the capsule rectifying apertures **44** are aligned directly beneath the capsule drop slots **34**. The funnels **54** have circular discharge openings **56** that are large enough to provide clearance for passage of the "0" size capsule shells **18** therethrough while in a vertical orientation. The capsule receiving tray **16**, visible in FIG. **1** and shown in plan view in FIG. **19**, has circular capsule receiving apertures **60** defined therethrough directly beneath the funnel discharge openings **56**, as best illustrated in FIGS. **7** and **8**.

Either the upper alignment plate **30** or the capsule rectifying plate **40** must be mounted in a laterally reciprocal fashion relative to the other of these plates. Preferably, the upper alignment plate **30** is rigidly secured to the funnel tray **42** and the capsule rectifying plate **40** is mounted for reciprocal movement therebetween. At least one, and preferably a pair, of horizontally oriented springs **66** are provided to bias the capsule rectifying plate **40** to a position in which the capsule rectifying apertures **44** are offset from vertical alignment with the capsule drop slots **34**. This condition is illustrated in FIG. **5**. The springs **66** are a pair of horizontally disposed, mutually parallel coil springs, the outboard ends of which are visible in FIG. **2**. The outboard ends of the coil springs **66** bear against the bearing ledges **67** of the capsule rectifying plate **40**. The bearing ledges **67** are visible in FIG. **4**.

The inboard ends of the horizontal springs **66** bear partially against the pocket walls **69** formed in the funnel plate **42**, visible in FIG. **3**, and partially against a corresponding pocket wall formed in the underside of the upper alignment plate **30**. The springs **66** bias the capsule rectifying plate **40** to the left, as viewed in FIG. **5**, which illustrates the capsule orienting position of the capsule rectifying plate **40** in which the capsule rectifying apertures **44** are at least partially laterally offset from the capsule drop slots **34**. If a lateral force **71** is applied against the edge of the capsule rectifying plate **40**, as illustrated by the directional arrow in FIG. **6**, the capsule rectifying plate **40** is movable in a laterally reciprocal fashion relative to the upper alignment plate **30** to the capsule discharge position illustrated in solid lines in FIG. **6**. In this position the capsule rectifying apertures **44** reside in vertical registration with the capsule drop slots **34**. Once the capsule shells **18** drop down to the capsule rectifying plate **16**, in a manner hereinafter described, a release of the manual force **71** allows the springs **66** to return the capsule rectifying plate **40** to the normal, offset capsule orienting position illustrated in FIG. **5** and in phantom in FIG. **6**.

The operation of the capsule orienting unit **12** is best described with reference to FIGS. **5-9**. A quantity of capsule shells **18** in the separable condition are poured from a supply onto the upper alignment plate **30** with the capsule rectifying plate **40** biased by the springs **66** to the capsule-orienting position illustrated in FIG. **5**. The capsule-orienting unit **12** may be manually shaken slightly with a lateral reciprocating movement until a separate capsule shell **18** resides nested in each capsule receiving cradle **32** and within each drop slot **34**, resting atop a portion of the capsule rectifying plate **40** located therebeneath. FIG. **5** illustrates capsule shells **18** occupying only the capsule drop slots **32** in the lower, left-hand corner of the upper alignment plate **30** so as to allow observation of the offset alignment of the capsule rectifying plate **40** therebeneath. However, it is to be understood that, in the normal use of the invention, there will be a total of fifty capsule shells **18** disposed in the fifty capsule drop slots **34**, one in each drop slot. Any excess capsule shells **18** that were not shaken into the capsule drop slots **34** are removed from atop the upper alignment plate **30**.

It should be noted in FIG. **5** that, when the capsule shells **18** rest in position in the capsule drop slots **34**, some of the capsule caps **20** will be oriented in one direction, while other of the capsule caps **20** will be oriented in the opposite direction. However, all of the capsule shells **18** are uniformly aligned within their respective capsule drop slots **34**, even though the capsule caps **20** of some of the capsule shells **18** are at opposite ends of the capsule drop slots **34** from each other.

Once any excess capsule shells **18** that have not lodged in a capsule drop slot **34** have been removed from the upper alignment plate **30**, a force **71** is manually applied to laterally shift the capsule rectifying plate **40** relative to both the upper alignment plate **30** and the funnel tray **42**. The application of this lateral force **71** is illustrated in FIG. **6**. As shown in that drawing figure, when the capsule rectifying plate **40** is shifted in this manner against the bias of the springs **66**, the capsule rectifying apertures **44** are all concurrently aligned directly beneath the capsule drop slots **34**.

FIG. **7** is a sectional elevational view taken along the lines **7-7** of FIG. **5** and illustrates the capsule shells **18** all residing in a horizontal disposition within their respective drop slots **34** with the capsule rectifying plate **40** in the normal capsule orienting position illustrated in FIG. **5**. Once the capsule rectifying plate **40** has been shifted by the manual application of the force **71**, however, the capsule shells **18** are no longer supported by the underlying capsule rectifying plate **40**. The capsule shells **18** then drop downwardly as illustrated in FIG. **8**.

Because of the length LM of the midsections **52** relative to the overall length L of each capsule rectifying aperture **44**, as shown in FIG. **25**, the lower end **21** of the capsule body **22** will always tilt downwardly before the upper end **23** of the capsule cap **20**, irrespective of which end the capsule cap **20** occupies in the capsule drop slot **34**. This is shown in FIG. **8**.

The present invention represents a significant improvement over prior systems that have attempted to achieve consistent, uniform, concurrent upright orientation of a multiplicity of capsules so that the capsule caps **20** are all located atop the capsule bodies **22**. For example, the Model CH100-00 Capsule Loader previously described employs a system in which a proportionate length of the capsule rectifying aperture midsections relative to the overall length of the capsule rectifying aperture is considerably greater than the proportionate length LM to the overall length L indicated in FIG. **25** of the present invention. Consequently, not infrequently the alignment of the capsule rectifying apertures with the capsule drop slots of that device results simply in a migration of the capsule shell to one end of the capsule rectifying aperture **44**. That is, instead of dropping, the capsule shell **18** merely slides toward one end of the capsule rectifying aperture **44** and simply hangs there.

Alternatively, in that prior art system the discharge of a capsule shell **18** sometimes results in the capsule making a one hundred eighty degree "forward flip", landing crosswise on the funnel below. When this occurs any capsule misaligned in its funnel must be forceably dislodged. Such malfunctions are aggravated by electrostatic charges on the capsule shells.

Due to the high surface area to mass ratio, the behavior of a gelatin capsule shall is adversely affected by the presence of static electricity that inevitably accumulates during handling. The presence of such static electricity was confirmed experimentally using an antistatic spray.

In order to obviate, or at least minimize, the undesirable effect of static electricity, no nonconducting materials are used in the capsule orienting unit **12**. In addition, a substantial metal mass aids in voltage distribution.

It is significant that, while there are a total of one hundred capsule receiving apertures **60** formed in the capsule receiving tray **16**, there are only fifty capsule drop slots **32** in the upper alignment plate **30**, only fifty capsule rectifying apertures **44** in the capsule rectifying plate **40**, and only fifty funnels **54** in the funnel tray **42**. The reason for this is that the capsule shells **18** occupy a considerably greater horizontal area when residing in the horizontal disposition in which they are introduced into the capsule orienting mechanism **12** than they do when dropped into the capsule receiving apertures **60** in the capsule receiving tray **16**. As a consequence, in order to fully load the capsule receiving tray **16**, it is necessary to fill the upper alignment plate **30** with capsule shells **18** twice and discharge them in two consecutive capsule drop operations.

The slots **184** in the framework end plate **86** are wider than the positioning lugs **182** on the ends of the funnel tray **42**. The slots **184** are bounded at their opposite ends by vertical abutment ledges **186**, as illustrated in FIG. **1**. The difference between the width of the positioning lugs **182** and the distance between the vertical abutment ledges **186** in the framework end plates **86** is equal to the horizontal distance between the center line of each two adjacent capsule receiving apertures

60. That is, the distance between the vertical abutment ledges **186** on each framework end plate **70** is equal to the spacing indicated at S in FIG. **19**. Therefore, each time the upper alignment plate **30** is filled with capsule shells **18**, the capsule alignment mechanism **12** is shifted laterally so that the positioning lugs **182** alternatively reside in contact with the vertical abutment ledge **186** closest to the scissors linkage **90**, or, the vertical abutment ledge **186** furthest from the scissors linkage **90** with each successful capsule orienting and drop operation.

With capsule shells **18** in their separable state or condition in each of the capsule drop slots **34**, the capsule rectifying plate **40** is shifted relative to the upper alignment plate **30** and the funnel tray **42** by application of a force **71**. Initially the capsule orienting device **12** is moved as close to the scissors linkage **90** as the abutment ledges **186** closest to the scissors linkage **90** will permit. Capsules are thereupon dropped into alternative horizontal rows, as viewed in FIG. **19**, commencing with the lowermost row. Fifty capsules are discharged from the capsule orienting unit **12** in this first operation.

The capsule orienting unit **12** is then shifted laterally in a direction away from the scissors linkage **90** as far as the vertical abutment ledges **186** furthest therefrom will permit. All of the fifty capsule drop slots **34** are again filled with capsule shells **18** in their separable states. The capsule rectifying plate **40** is then again shifted to the right by the application of a force **71**, as viewed in FIG. **6**. The fifty capsules then in the upper alignment plate **30** will thereupon drop vertically downwardly through the funnel openings **56** and into each of the capsule receiving apertures **60** in every other horizontal row, as viewed in FIG. **19**, commencing with the second row from the bottom, as viewed in that drawing figure. It can be seen, therefore, that, with two sequential operations of the capsule orienting unit **12** atop the capsule receiving tray **16**, all of the capsule receiving apertures **60** will be filled with capsule shells **18** in their separable state.

When the capsule rectifying plate **40** is pushed inwardly as illustrated in FIG. **6** by a force **71**, the capsule shells **18** will drop from their horizontal orientation illustrated in FIG. **7** into their respective funnels **54**, as illustrated in FIG. **8**. As shown in FIG. **8**, with the relative dimensions of the capsule rectifying apertures **44** as illustrated in FIG. **25**, and as described herein, the lower end **21** of the capsule body **22** will always drop first, irrespective of the end of the capsule drop slot **34** at which the capsule cap **20** is located. Consequently, all of the capsule shells **18** will drop into their respective funnels **54** into a vertical orientation as illustrated in phantom in FIG. **8**. The capsule cap **20** will always be on top and the capsule body **22** will always be directed downwardly beneath the cap **20**.

The funnel discharge openings **56** are just slightly larger than the diameters of the capsule caps **20** so that the capsule shells **18** are in a vertical orientation with the capsule caps **20** on top and the capsule body **22** beneath when the capsule shells **18** reach the bottoms of the funnels **54**. The capsule shells **18** drop through the funnel discharge openings **56** and directly into the capsule receiving apertures **60** in the capsule receiving tray **16**. The capsule receiving apertures **60** are each of a diameter just slightly larger than the diameter of the capsule bodies **22** and slightly smaller than the diameter of the capsule caps **20**. The capsule receiving apertures **60** are arranged in corresponding vertical alignment with the discharge openings **56** of the funnels **54**.

To summarize, the manually operated apparatus for uniformly orienting a multiplicity of oblong capsule shells **18** of circular cross section may be briefly described as follows. Each of the capsule shells **18** has a cap **20** fitted telescopically onto a small diameter body **22**, but with the upper edge **19** of the capsule body **22** still located a short distance from the radially inwardly directed rib **24**. The capsule shells **18** are in a separable state or condition prior to being filled.

The capsule tipping or rectifying plate **40** is located beneath the upper alignment plate **30** and has tipping or rectifying apertures **44** therein shaped as the capsule shells **18**, but having opposing ends **48** and **50** that are wider than the capsule bodies **22** and narrower than the capsule caps **20**. The mid sections **52** of the tipping or rectifying apertures **44** are widened. That is, their transverse dimension D is slightly greater than the diameter of the capsule caps **20**. The length LM of the midsections **52**, relative to the entire length L of the capsule rectifying apertures **44**, is between about fifteen percent and twenty percent of the total length of the tipping or rectifying apertures **44**. The measure of the length of the midsection **52** to the entire length of the capsule rectifying apertures **44** between the opposing ends **48** and **50** thereof is between 0.15 and about 0.20 to one. The midsections **52** of the tipping apertures **44** preferably have a length of between about seventeen percent of the total length of the tipping apertures **44**.

A funnel tray **42** is located beneath the capsule rectifying plate **40** and includes a rectilinear matrix of funnels **54** located beneath the drop apertures **34**. The funnels **54** are provided for receiving the capsule shells **18** from the capsule tipping or rectifying plate **40**. The funnels **54** have circular discharge openings **56** large enough to provide clearance for passage of the capsule shells **18** therethrough while in a vertical orientation.

The funnel tray **42** and the upper alignment plate **30** are rigidly joined to each other and a capsule rectifying or tipping plate **40** is mounted between the upper alignment plate **30** and the funnel tray **42**. The capsule tipping or rectifying plate **40** is movable in laterally reciprocal fashion relative to the alignment plate **30** and the funnel tray **42**, as indicated by the force **71** in FIG. **6**.

As shown in FIGS. **5** and **6**, the tipping or rectifying apertures **44** are alternatively aligned and misaligned with the capsule drop slots **34**. Alignment unit springs **66**, visible in FIG. **2**, bias the tipping plate **40** to a condition in which the tipping apertures **44** are misaligned with the drop apertures **34**.

The capsule receiving apertures **60** in the capsule receiving tray **16** are each of diameter larger than the diameter of the capsule bodies **22** and smaller than the diameter of the capsule caps **20**. The capsule receiving apertures **60** are arranged in corresponding vertical alignment with the funnels **54**. The upper alignment plate **30**, the capsule rectifying or tipping plate **40**, and the funnel tray **42** are assembled together as a capsule orienting unit **12**. The capsule orienting unit **12** is removably positionable upon the capsule receiving tray **16**.

The capsule separation assembly is comprised of the capsule receiving tray **16**, a capsule body retention tray **68**, partially visible in FIGS. **1** and **16**, a framework **70** that maintains the capsule body retention tray **68** and the capsule receiving tray **16** parallel to each other in a static condition, and a capsule top lift assembly **72**, illustrated in FIG. **10**.

The capsule body retention tray **68** is located beneath the capsule receiving tray **16** and has capsule body retaining openings **74** with capsule body gripping rings **76** therein, as illustrated in the detail views of FIGS. **27-30**. Capsule alignment apertures **75** are defined concentrically within the capsule body retaining openings **74** at the upper surface **81** of the capsule body retention tray **68** and are of a diameter just slightly larger than the outer diameter of the capsule body **22**.

A single one of the capsule body gripping rings **76** is illustrated in isolation in a sectional elevational detail in FIG. **17**, and in a plan detail in FIG. **18**. Each of the capsule body gripping rings **76** is formed of a thin, circular, annular, stainless steel wafer and has a circular outer perimeter with a central opening therein of a generally cruciform shape with rounded ends, as illustrated in FIG. **18**. Each of the capsule body gripping rings **76** is formed with deflectable gripping tabs or flanges **78** defined between the four rounded ends of the central cruciform opening **77**. The capsule body gripping rings **76** are split at a radial demarcation **79**.

The capsule body gripping rings **76** are mounted in the capsule body retaining openings **74** and are held in position by cylindrical, annular retaining rings **80** that are friction fitted into the capsule body retaining opening **74** beneath the capsule body retaining rings **76**. The retaining rings **80** support the peripheral margins of the capsule body gripping rings **76** from beneath, but leave a narrow gap within the capsule body retaining openings **74** to allow a certain amount of "play" in an axial direction at the peripheral margins of the capsule body gripping rings **76**. That is, the distance from the upper edges of the retaining rings **80** to the undersurfaces **82** of the annular web of material of the capsule body retention tray **68** surrounding the capsule alignment apertures **75** is slightly greater than the thickness of the capsule body gripping rings **76**.

The framework **70** of the capsule separation assembly **14** includes a pair of opposing, vertical upright framework end plates **86** which are anchored to and rigidly support the capsule body retention tray **68** in a horizontal disposition at an intermediate location beneath the capsule receiving tray **16** and above a horizontally oriented capsule sealing plate **88**.

The funnel tray **42** is provided with a pair of positioning lugs **182** at its opposing ends. The positioning lugs **182** are received in corresponding slots **184** formed in the inner face of the framework end plates **86**.

A scissors linkage **90** is used to support the capsule receiving tray **16** at a variable distance above the stationary capsule body retention tray **68**. The scissors linkage **90** includes a pair of linear, intersecting bars **92** and **94**. The bars **92** and **94** are pivotally connected to each other at their centers by a pivot connection **96**. The lower extremities of the scissors linkage bars **92** and **94** are pivotally connected to the opposing ends of the capsule body retention tray **68** by means of rotatable couplings **98**. Similarly, the upper extremities of both of the scissors linkage bars **92** and **94** are coupled to opposing ends of the capsule receiving tray **16** by pivotal connections **100**. The pivot connections **98**, **100** at the right-hand end of the scissors linkage **90** are sliding connections. That is, the pivot pins **98**, **100** at the right-hand end of the scissors linkage **90** are securely attached to the capsule receiving tray **16** and the capsule body retention tray **68** respectively. These pivot connections pass through elongated eyes **93** at the right-hand ends of the scissors linkage bars **92** and **94** so that the scissors linkage **90** is able to collapse. The elongated sliding coupling eyes are shown in FIGS. **15**, **22**, and **24**.

A pair of bellcrank levers **102** are joined to the opposing ends of the framework end plates **86** by pivot connections **104**. The bellcrank levers **102** are mounted on the framework **70** and are rotatable about horizontal axes at their pivot connections **104**. The bellcrank levers **102** have U-shaped handgrips **106** and a pair of opposing feet **108** oriented perpendicular to the U-shaped handgrips **106**.

In addition to the lower portion **14**, the capsule separation assembly also includes a capsule top lift assembly **72**. The capsule top lift assembly **72** is illustrated in section in the exploded view of FIG. **12**. Specifically, the capsule top lift assembly **72** is comprised of a capsule cap retention tray **110** and a capsule top pressure plate **112**. The capsule top pressure plate **112** is located above the capsule cap retention tray **110**.

The capsule top pressure plate **112** is a rectangular plate having a smooth upper surface and is provided with a multiplicity of depending cap pressure posts **114** oriented in a matrix and located concentrically above and in alignment with capsule cap receiving openings **114** in the capsule cap retention tray **110**. The ends of the depending extremities of the capsule cap pressure posts **114** are rounded in a concave manner to form positioning seats **118**. The positioning seats **118** are curved to conform to the convex surface curvature of the upper ends **23** of the capsule caps **20**.

At its four corners the top pressure plate **112** is provided with countersunken bolt apertures **120** designed to receive the heads of bolts **121**. The distal extremities **123** of the shanks of the bolts **121** are externally threaded to engage internally tapped bolt openings **126** at the four corners of the capsule cap retention tray **110**. A vertically oriented, compressible coil spring **128** is disposed coaxially about the shanks of each of the bolts **121**. The vertically oriented springs **128** serve to bias the top pressure plate **112** away from the capsule cap retention tray **110**.

The capsule cap receiving tray **110** has capsule cap receiving holes **130** defined therein at the position of each capsule shell **18**. The capsule receiving holes **130** are stepped in diameter and have a relatively large aperture **132** at the top surface of the capsule cap receiving tray **110**, and a relatively small, concentrically located capsule cap guide opening **134** at the bottom surface of the capsule cap receiving tray **110**. Radially outwardly directed channels are formed in the structure of the capsule cap receiving tray **110** at each of the capsule cap receiving holes **130** therein at the demarcations between the capsule cap receiving apertures openings **132** and the capsule cap guide openings **134**. Radial channels are defined in the wall structure of the capsule cap receiving tray **110** at each of the capsule cap receiving holes **130** therein. Each radial channel receives a resilient, rubber, capsule cap grasping ring **136**.

Each of the capsule cap grasping rings **136** has a central, frustoconically-shaped aperture **138** defined therethrough. Each aperture **138** has a narrower diameter opening facing the relatively large diameter aperture **132** and a larger diameter opening equal to the diameter of the capsule cap guide opening **134**. The grasping rings **136** thereby exert less frictional force against movement of the capsule caps **20** therethrough in a direction away from the capsule receiving tray **16**, than in a direction toward the capsule receiving tray **16**. The capsule cap grasping rings **136** permit passage of the capsule caps **20** therethrough and provide greater resistance to movement of the capsule caps **20** therethrough in a direction toward the capsule receiving tray **16** than away from the capsule receiving tray **16**.

As illustrated in FIG. **10**, the capsule top lift assembly **72** is removably positionable atop the capsule receiving tray **16**. The undersurface of the capsule cap retention tray **110** is provided with a pair of linear channels **140**, as shown in FIG. **12**. The channels **140** are parallel to each other and receive the upper end walls **142** that project upwardly from the capsule receiving tray **16**, shown in FIGS. **10** and **19**. The channels **140** are deeper than the height of the grooves **142** in order to enable the bottom surface of the capsule cap receiving tray **110** to come into intimate contact with the upper surface of the capsule receiving tray **16**.

The top pressure plate **112** is slightly smaller in size than the capsule cap retention tray **110** so as to provide clearance for the feet **108** of the bellcrank levers **102**. The bellcrank levers **102** can thereby engage the end margins of the capsule cap retention tray **110** yet the feet **108** clear the ends of the top pressure plate **112** when the levers **102** are rotated upwardly and toward each other from the positions shown in FIGS. **1** and **13** to the raised position shown in FIG. **15**.

The framework **70** is provided with four vertically oriented coil springs **144**, one at each corner. The vertically oriented coil springs **114** are illustrated in phantom in FIG. **19** and one of them is visible in FIG. **16**. The upper ends of the vertically oriented springs **114** are seated in positioning wells **118** defined in the underside of the capsule receiving tray **16**. The lower ends of the vertical springs **114** are similarly seated in upwardly facing positioning wells **120** defined in the structure of the capsule sealing plate **88**. The vertically oriented springs **114** are inset slightly from the corners of the capsule receiving tray **16**, as illustrated in FIG. **19**, and also the capsule body retention tray **68** and the capsule sealing plate **88**, which are located vertically beneath the capsule receiving tray **16** and in a parallel orientation relative thereto.

FIG. **16** is a partially broken away elevational view illustrating one of the vertically oriented springs **114**. As shown in that drawing figure, the springs **114** pass through apertures **116** defined entirely through the structure of the capsule body retention tray **68**. The capsule sealing plate **88** normally rests atop the inwardly directed toes **122** of the framework corner end posts **124** located at the corners of the transverse framework end plates **86**, as best illustrated in FIGS. **16** and **22**. The capsule sealing plate **88** thereby normally forms a solid base supported by the frame **70** and located by the guide pins **129**. The compressed coil springs **114** normally bias the cap receiving tray **16** upwardly relative to the framework **70**. The vertically oriented springs **114** project upwardly from the sealing plate **88**, through the openings **116** in the capsule body retention plate. The springs **114** thereby normally bias the capsule receiving tray **16** up away from both the capsule body retention tray **68** and the capsule sealing plate **88** unless forces are exerted to compress them.

The bellcrank lever mechanisms **102** are joined to the framework **70** and are operable against the force of the vertical biasing springs **114**. The lever mechanisms **102** are operable to entrap the capsule cap retention tray **110** directly atop and in face to face contact with the capsule receiving tray **16**. The bellcrank lever mechanisms **102** can be used to overcome the force of the springs **114** so as to press the capsule cap retention tray **110** and the capsule receiving tray **16** together toward the capsule body retention tray **68** by collapsing the tray support linkage **90**.

The capsule cap retention tray **110** is positionable directly atop the capsule receiving tray **16**. The capsule cap retention tray **110** has capsule cap receiving holes **130** therein equipped with capsule cap grasping rings **136**. The grasping rings **136** exert less frictional force against movement of the capsule caps **20** therethrough in a direction away from the capsule receiving tray **16** than in a direction toward the capsule receiving tray **16**.

The capsule separation assembly **14** is further comprised of guide pins **129** which are positioned at locations parallel to the framework end plates **86** approximately midway between the framework corner support posts **124** at the ends of the framework end plates **86**. The guide pins **129** pass through and are secured to the capsule body retention tray **68**. The guide pins **129** project upwardly and their upper extremities are visible through the guide pin openings **131** in the end flanges **133** of the capsule receiving tray **16**, shown in FIG. **19**.

FIG. **14** is a side elevational view illustrating in detail a single one of the guide pins **129**. The guide pins **129** are generally cylindrical in shape and have a lower end **132** that is 0.174 inches in diameter. There is an annular, frustoconical transition **135** from the lower end **132** of the guide pin **129** to the midsection **137** thereof. The guide pins **129** are all solidly anchored to the capsule body retention tray **68** at the transition **135**. The angle of inclination of the transition section is thirty degrees relative to the axial alignment of the guide pin **129**. The midsection **137** of the guide pin **129** is 0.188 inches in diameter.

At the upper termination of the midsection **137** there is a neck **139** defined in the guide pin **129**. The neck **139** has central diameter of 0.174 inches with a radius of curvature to the midsection **137** of 0.032 inches.

Above the neck **139** the guide pin **129** widens to form an upper section **141** having a diameter of 0.188 inches. Above the upper section **141** the guide pin **129** narrows with a frustoconical incline of seventeen degrees relative to the axial alignment of the guide pin **129** to form a nose surface **143**. The top **145** of the guide pin **129** has a diameter of 0.136 inches.

The dimensions of the guide pin **129** are quite important for ensuring proper vertical alignment of the various components of the capsule separation assembly **14** during movement of different components thereof. The guide pins **129** and the scissors linkage **90** maintain the capsule retention tray **68** and the capsule receiving tray **16** parallel to each other when the capsule receiving tray **16** is pushed toward the capsule retention tray **68**. A nonparallel, noncongruent condition between these trays would cause binding and misalignment between them.

The framework **70** is provided with four push rod mounting blocks **146** located just inboard the framework corner end posts **124**, as illustrated in FIG. **1**. The push rod mounting blocks **146** have vertical guide bores defined therethrough. Although illustrated as separate structures, the push rod mounting blocks **146** can be formed as portions of the end plates **70**. Push rods **148** are disposed within the guide bores for vertical reciprocal movement therewithin. The cylindrical push rods **148** are captured so that they will not drop out of the bores through the push rod mounting blocks **146** by means of split expansion rings **150**. The rings **150** are secured by spring tension in radially outwardly facing channels near the lower extremities of the push rods **148**, as indicated in the detail view of FIG. **16**.

Directly beneath the push rods **148** there are rocker arms **152** mounted for rotation about horizontal axes of rotation by means of bolts **154** that pass through transverse bores through the rocker arms **152**. Each of the rocker arms **152** has a force application end **156** projecting out away from the frame **70**, and an opposite force transmission end **158** that projects inwardly and resides directly beneath the ends of the capsule sealing plate **88**, as best illustrated in FIG. **16**.

The framework **70** is also provided with a pair of releaseable latches **160**, visible in FIG. **1**, but more clearly illustrated in FIGS. **13** and **15**. The latches **160** are each formed with a transverse, cylindrical rod **162** from which a pair of laterally spaced latching pins **164** extend at right angles relative thereto. The latching pins **164** are anchored to the latch push rod **162** and extend through parallel, horizontally oriented latch pin guide apertures defined through the structure of the framework end plates **86** near the upper extremities thereof. Roll pins are pressed into transverse apertures through the tips of the latch pins **164** remote from the push rods **162**. The roll pins project beyond the outer diameter of the latch pins **164** and thereby prevent complete withdrawal of the latches **160** from the framework **70**. That is, the tips of the latch pins **164** remote from the push rods **162** will not pass through the latch pin guide apertures in the framework end plates **86**.

The capsule sealing plate **88** is provided with a multiplicity of upwardly projecting ram posts **166**, one of which is visible in FIGS. **27-30**. The ram posts **166** are vertically and coaxially aligned with both the capsule body retaining openings **80** in the capsule body retention tray **68** and also with the capsule receiving apertures **60** in the capsule receiving tray **16**. The upper tips **168** of the ram posts **166** are formed with arcuately curved, upwardly facing concave surfaces **168**, the curvature of which confirms to the curvature of the lower ends **21** of the capsule bodies **22**.

The apparatus of the invention is also preferably provided with a tamping device **170**, illustrated in FIGS. **20** and **21**. The tamping device **170** is comprised of a flat steel tamping plate **172** having a pair of U-shaped handles **174** projecting upwardly perpendicular thereto at the opposing ends of the steel tamping plate **172**. The tamping plate **172** has a pair of positioning lugs **176** at its opposing ends that fit into corresponding shallow channels **196** in the interior faces at the upper extremities of the framework end plates **86**. The positioning lugs **176** ensure proper alignment of the tamping plate **172** relative to the capsule receiving tray **16**.

The underside of the tamping plate **172** is provided with a matrix of right cylindrical tamping posts **178** which are located in coaxial alignment with the corresponding capsule receiving apertures **60** when the tamping assembly **170** is properly positioned atop the capsule receiving tray **16**. The diameter of each of the tamping posts **178** is just slightly smaller than the inner diameter of each capsule body **22**.

The operation of the capsule separation assembly may be described as follows. Once all of the capsule shells **18** have been dropped into the capsule receiving apertures **60** from the capsule orienting apparatus **12**, as previously described, the capsule orienting apparatus **12** is removed from atop the capsule receiving tray **16**, as illustrated in FIG. **1**. All of the capsule shells **18** at this stage are still in their separable state. That is, the capsule caps **20** are fitted telescopically onto the open upper ends of the capsule bodies **22**, but the upper ends **19** of the capsule bodies **22** are not pushed past the radially inwardly directed ribs **24** of the capsule caps **20**.

After all of the drop apertures **32** of the upper alignment plate **30** have been filled with capsule shells **18** in a separable condition, and following actuation of the capsule rectifying plate **40** to drop the capsule shells **18** into the capsule receiving tray **16**, as illustrated in FIGS. **7**, **8**, and **9**, each of the capsule receiving apertures **60** in the capsule receiving tray **16** will contain a single capsule shell **18**. Each capsule shell **18** is oriented with the capsule cap **20** atop the capsule body **22** and with the lower edge of the capsule cap **20** resting atop the flat, perforated floor **59** of the capsule receiving tray **16**. Only a single one of the capsule receiving apertures **60** is shown as occupied by a capsule shell **18** in FIG. **9** to allow greater clarity of illustration of the capsule receiving tray **16** and the capsule body retention tray **68**. However, it is to be understood that each of the one hundred capsule receiving apertures **60** contains a separate capsule shell **18**, oriented as illustrated at the second aperture **60** from the left of FIG. **9**.

It is then necessary to separate the capsule caps **20** from the capsule bodies **22**. Separation of the capsule caps **20** from the capsule bodies **22** is performed utilizing the capsule separation unit. To commence the separation process the capsule top lift assembly **72** is lowered into position onto the capsule receiving tray **16**, as illustrated in FIG. **10**. The undersurface of the capsule cap retention tray **110** is configured so that the central, generally square portion of it between the channels **140** will just fit within the confines of the boundary rim **17** formed about the floor **59** containing the matrix of capsule receiving apertures **60** in the capsule receiving tray **16**.

FIG. **27** is a detail view illustrating the relationship between a single capsule shell **18** and the aligned apertures of the capsule separation assembly **14** as the capsule top lift assembly **72** is lowered onto the capsule receiving tray **16**. As the capsule cap retention tray **110** is moved into contact with the capsule receiving tray **16**, as shown in FIG. **18**, the capsule cap grasping rings **136** are supple enough to permit passage of the upper portion of the capsule cap **20** therethrough.

It is the circumferential annular abutment ridge formed by the difference in diameter between a cap **20** and its body **22** bearing on the plate **16** that forces the cap **20** into upper plate assembly **72**, hence the need for low admission friction of ring **136** as the gelatin or cellulose material used in capsule manufacture is weak and subject to fracture, and the available bearing area against the surface **59** of the capsule receiving tray **16** is small. At this point, the bottom end **21** of the capsule body **22** is in the vicinity of the gripper **76**, but the capsule body **22** has yet to be engaged. After having been pressed home by hand with enough force to cause the lower surface of the capsule cap retention tray **110** to come in contact with the upper surface **59** of the capsule receiving tray **16**, if the top plate assembly **72** is removed, the unseparated capsules will be withdrawn with it. It is true that if the length of the capsule cap **20** is short enough, it may be pressed further into the upper capsule cap retention tray **110** cavity by virtue of the force of engagement between the capsule body **22** and the gripper ring **76**. However, this effect is not of primary importance. Because cap lengths vary from manufacturer to manufacturer, the cavity formed by the capsule cap retention tray **110** and the sealing plate **112** must be deep enough to accommodate the longest caps **20** while allowing the ends of the capsule caps **20** to be flush with the bottom surface of the capsule cap retention tray **110**.

When the capsule cap lift assembly **72** is lowered into position, as illustrated in FIG. **28**, the capsule cap bearing posts **114** depending from the underside of the capsule cap sealing plate **112** reside just above, or slightly in contact with the rounded upper ends **23** of the capsule caps **20**, as illustrated in FIG. **28**. However, at this point in the separation process, the capsule cap bearing posts **114** do not exert any pressure on the top surfaces **23** of the capsule caps **20**.

Once the capsule top lift assembly **72** has been placed upon the capsule receiving tray **16** so that the undersurface of the capsule cap retention tray **110** resides in contact with the exposed upper surface of the capsule receiving tray **16**, the capsule caps **20** are lightly engaged with the capsule cap retention tray **110** by virtue of the light frictional grip exerted on them by the capsule cap grasping rings **136**. FIG. **13** illustrates the capsule top lift assembly **72** positioned atop the capsule receiving tray **16**. However, a further step is necessary in order to ensure that the capsule bodies **22** remain in position in the capsule receiving tray **16** before the capsule top lift assembly **72** can be removed.

As illustrated in FIG. **15**, with the capsule top lift assembly **72** positioned atop the capsule receiving tray **16**, the bellcrank lever mechanisms **102** that are rotatably mounted relative to the framework end post **124** are rotated upwardly and toward each other. The bellcrank levers **102** are operated by manually grasping the U-shaped lever arm handles **106** formed at the outboard ends of the bellcrank levers **102** and lifting them up concurrently, as illustrated in FIG. **15**.

The upward rotation of the bellcrank levers **102** causes the feet **108** thereof to press downwardly upon the marginal edges of the ends of the capsule cap retention tray **110**. Since the capsule cap sealing plate **112** is slightly smaller than the capsule cap retention tray **110**, the springs **128** continue to hold the capsule cap sealing plate fully elevated above the capsule cap retention tray **110** so that no downward force is exerted directly on the capsule caps **20**. To the contrary, the downward force is exerted by the bellcrank levers **102** when actuated as illustrated in FIG. **15** to concurrently force the capsule body retention tray **110** and the capsule receiving tray **16** beneath it together toward the capsule body retention tray **68** in the manner illustrated in FIG. **29**. The downward stroke of the bellcrank levers **102** is stopped when the approaching capsule receiving tray **16** contacts capsule body retention tray **68** in such a manner that essentially no distance of separation exists between the bottom surface of the capsule receiving tray **16** and the top surface **81** of the capsule body retention tray **68**, as illustrated in FIG. **30**.

As shown in FIG. **29**, the downward movement of the capsule receiving tray **16** and the capsule cap receiving tray **110** toward the capsule body retention tray **68** causes the capsule body **22** to be pushed further into the capsule body receiving opening **80** of the capsule body retention tray **68**. That is, the capsule body retaining flanges **78** are sufficiently resilient to deflect downwardly to the extent illustrated in FIG. **29**. Downward movement of the capsule receiving tray **16** and the capsule cap receiving tray **110** by the force applied through the bellcrank levers **102** partially compresses the coil springs **114** to allow the capsule receiving tray **16** to be pushed closer to the capsule body retention tray **68**, as illustrated in FIG. **29**. The downward movement of the capsule body **22** is such that the lower end **21** of the capsule body **22** resides just above, or barely in contact with the concave upwardly facing surfaces **168** of the ram posts **166** which project upwardly from the sealing plate **88**.

At this point in the separation process, the capsule cap grasping rings **136** lightly grip the capsule caps **20**, while the capsule body gripping rings **76** lightly grip the capsule bodies **22**. The capsule top lift assembly **72** can then be lifted free from the capsule receiving tray **16**, as shown in FIG. **10**. As the capsule top lift assembly **72** is removed, it carries with it all of the capsule caps **20** engaged by the capsule grasping rings **136** in the capsule cap retention tray **110**. The capsule gripping rings **76** hold the capsule bodies **22** within the capsule body retention tray **68**. The capsule top lift assembly **72** is then set aside for the moment.

When the downward force applied by the bellcrank levers **102** is released, and the bellcrank levers **102** are returned to the conditions illustrated in FIGS. **1** and **13**, the coil springs **114** push the capsule receiving tray **16** back up to its rest position as determined by projections formed in side plates **70**. At this point, since the capsule bodies **22** remain stationary, the top surface of capsule receiving tray **16** is flush with, or slightly above, the upper edges **19** of the capsule bodies **22**. The total travel of the capsule receiving tray **16** is calculated to ensure that (1) each capsule body **22** is fully engaged with its gripper **76**, and (2) that the upper edges **19** of the capsule bodies will not project above the floor **59**, thereby interfering with the uniform spreading of filler material. The grippers **76** must be allowed to float in their retaining pockets in order to maintain axial alignment with the capsule bodies. However, they must not be allowed to have much lateral movement in order to ensure that the capsule bodies **22** are not partially withdrawn as a result of the friction exerted by the capsule receiving tray **16** during its migration back to its rest position, and the frictional forces caused by removal of the caps **20** from the bodies **22**.

With the capsule top lift assembly **72** removed from atop the capsule receiving tray **16**, the upper ends **19** of the capsule bodies **22** reside in flush, coplanar relationship with the upper, horizontal floor surface of the capsule receiving tray **16**. A quantity of medicament, vitamin material, or other contents with which the capsule shells **18** are to be filled is then poured onto the flat, horizontal surface **59** of the capsule receiving tray **16**. The capsule filler material is normally a powdered substance **99** which will flow freely into the open mouths of the capsule bodies **22**. Any excess material is swept off of the floor **59** through the gate opening **61** on one side of the boundary rim **17** of the capsule receiving tray **16**.

It is then usually advisable to tamp down the capsule filler material into the capsule bodies **22**. The tamping assembly **170** is employed for this purpose.

The tamping assembly **170** is positioned directly over the capsule receiving tray **16**, once the capsule bodies **22** have been filled with capsule filler material and lowered into position. The end positioning lugs **176** of the tamping plate **172** are guided by the guide opening slots **196** in the inwardly facing surfaces of the upper extremities of the framework end plates **86**. The tamping rods **178** fit smoothly within the circular open mouths of the capsule bodies **22** so that the capsule filler material can be easily tamped down.

The tamping device **170** is then removed and the capsule top lift assembly **72** replaced atop the capsule receiving tray **16** in the manner previously described. At this point in the process it is necessary to seal the capsule shells **18**.

The first step in the capsule sealing process is to again raise the bellcrank levers **102** from their relaxed, normal, horizontally extending positions illustrated in FIGS. **1** and **13**, to their raised positions illustrated in FIG. **15**. This rotation of the bellcrank levers **102** again compresses the coil springs **114** and pushes the capsule cap receiving tray **110** and the capsule receiving tray **16** together downwardly toward the capsule body retention tray **68**, to the position illustrated in FIG. **30**. At this point it is necessary to latch the capsule cap receiving tray **110** and the capsule receiving tray **16** in the depressed condition illustrated in FIG. **15**. To do this the releaseable latches **160** are employed.

The latch bars **162** are pressed toward each other, thereby carrying the latch pins **164** through the latching pin guide bores near the upper edges of the framework end plates **86**. The tips of the latch pins **164** thereupon project out over the upper edges of the capsule cap retention tray **110**, thereby holding the capsule receiving tray **16** in the condition depressed toward the capsule body retention tray **68**. The components will thereupon reside in the dispositions illustrated in FIG. **30**.

The bellcrank levers **102** are then released to their relaxed, normally horizontal orientation as illustrated in FIG. **22**. However, as also shown in that drawing figure, the scissors linkage **90** has been collapsed and the springs **114** are held in a partially compressed condition, since the latch pins **164** project out over the edges of the capsule cap receiving tray **110** and prevent the capsule top lift assembly **72** from rising.

The capsule sealing plate **88** is disposed horizontally and is oriented perpendicular to the framework end plates **86**. The capsule sealing plate **88** normally rests atop the toes **122** of the framework end corner posts **124**. However, in order to seal the capsule shells **18**, the capsule sealing plate **88** must be raised.

The bellcrank levers **102** are then counterrotated downwardly as illustrated in FIG. **24**. The downward force on the bellcrank lever handles **108** forces the sealing force transmissions push rods **148** downwardly from the positions illustrated in FIG. **16**. The lower extremities of the push rods **148** are pressed downwardly against the outboard ends **156** of the rocker arms **152**, thereby causing the inboard ends **158** of the rocker arms **152** to be pressed upwardly against the opposing force of the springs **114**. This upward force against the underside of the sealing plate **88** lifts the sealing plate **88** and causes the ram posts **166** to be forced upwardly from the positions shown in FIG. **29**.

The sealing plate **88** is pressed upwardly, thereby forcing the capsule bodies **22** up into the capsule caps **20**, as illustrated in FIG. **30**. The upward movement of the capsule bodies **22** relative to the capsule caps **20** caused by the counterrotation of the bellcrank levers **102** forces the upper edges **19** of the capsule bodies **22** upwardly past the radially inwardly projecting ribs **24** in the interior walls of the capsule caps **20**. Upward movement proceeds until the ribs **24** in the inner walls of the capsule caps **20** engage the grooves **25** formed in the outer walls of the capsule bodies **22**. Once the ribs **24** engage the grooves **25**, the capsule caps **20** are firmly secured to the capsule bodies **22** and are tightly and permanently sealed thereto. The capsule shells **18** are thereupon all in the sealed state or condition.

Concurrently with the sealing of the capsule caps **20** relative to the capsule bodies **22**, the bottom ends **21** of the capsule bodies **22** are pushed upwardly relative to the capsule gripping apertures **80** of the capsule body retention tray **68** to a sufficient extent that they again rest atop the capsule support flanges **78**. Normally, once the capsules have been assembled in their locked positions, the capsule bodies still remain engaged with gripper rings **76**. Also, the frictional drag exerted on the capsule walls of by the gripper rings **76** is relatively large. The gripper rings **76** play a very important part in the operation of the machine of the invention. The function that they perform is absolutely vital. This is why the gripper rings **76** are made of thin stainless steel, rather than rubber, which has an uneven performance. The machine of the invention works because the frictional force of the capsule body **22** entering the gripper ring **76** is substantially less than the force required to lock the capsule parts together. Also, because the frictional force of the gripper **76** restraining the capsule body **22** is substantially greater than the force required to separate the capsule cap **20** from the capsule body **22**, the capsules **18** will separate when the top plate assembly is removed.

The bellcrank levers **102** are then released from the counterrotation position shown in FIG. **24** and rotated back up toward each other to the positions illustrated in FIG. **15**. The latching rod handles **162** are then pulled back apart from each other, as illustrated at **162'** in FIG. **15**. Once the latches **160** have been pulled out away from the frame **70**, the latch pins **164** no longer project atop the upper, outboard edges of the capsule cap retention tray **110**.

The capsule top lift assembly **72** can now be withdrawn from atop the capsule receiving tray **16**. With the capsule top lift assembly **72** removed from the capsule receiving tray **16**, the plate **112** is pressed to eject the sealed capsules **18** that are now ready for packaging. Alternatively, if the top lift assembly **72** is difficult to remove, the side levers **102** can be rotated downwardly as shown in FIG. **24** in order to overcome the cumulative friction of the capsule body gripping rings **76** that exceed the return force of springs **114**.

The process of capsule separation for filling may be summarized as follows. The apparatus of the invention may be used to separate a multiplicity of oblong capsule shells **18** which are in a separable state. The capsule shells **18**, in their separable state, are first oriented upright utilizing the capsule orienting unit **12** and are dropped into a capsule receiving tray **16** having a matrix of circular capsule receiving apertures defined therein. A capsule body retention tray **68** is positioned directly beneath the capsule receiving tray. Each of the capsule bodies **22** is located directly above a separate capsule retaining apertures **80** containing a capsule body gripping ring **76** in the capsule body retention tray **68**. The capsule body gripping rings **76** exert less frictional force against the movement of the capsule body therethrough and away from the capsule receiving tray **16** than in a direction toward the capsule receiving tray **16**.

A capsule cap retention tray **110** is located directly atop the capsule receiving tray **16**. The capsule cap retention tray **110** has capsule cap receiving holes **130** therein equipped with capsule cap grasping rings **136**. The rings **136** exert less frictional force against movement of the capsule caps **20** therethrough in a direction away from the capsule receiving tray **16** than in a direction toward the capsule receiving tray **16**.

The capsule cap retention tray **110** and the capsule receiving tray **16** are pressed together toward the capsule body retention tray **68**. The capsule bodies **22** are advanced into the capsule body gripping rings **76** and the capsule caps **20** are advanced into the capsule cap grasping rings **136**.

The capsule body retention tray **68** is located beneath the capsule receiving tray **16** and has capsule body retaining openings **74** with capsule body gripping rings **76** therein. The capsule body gripping rings **76** are formed as thin metal discs having central cruciform openings **77** defined therein. These openings are formed with capsule body retaining flanges **78** directed at an inclination out of the plane of the periphery of the gripping rings **76** and away from the capsule receiving tray **16**. The capsule body gripping rings **76** frictionally grip capsule bodies **22** received therein. The capsule body gripping rings **76** provide greater resistance to movement through their openings **77** in a direction toward the capsule receiving tray **16** than in a direction away from the capsule receiving tray **16**.

The capsule body retention tray **68** and the capsule receiving tray **16** are maintained parallel to each other by a framework **70**. The capsule sealing plate **88** is located beneath the capsule body retention tray **16**. The framework **70** is provided with a tray support linkage **90**, which is a scissors linkage, that collapses to permit movement of the capsule receiving tray **16** toward the capsule body retention tray **68**.

The framework **70** is also provided with bellcrank lever mechanisms **102** joined to the framework **70** and operable against the force of vertically biasing springs **114**. The springs **114** are coil springs that pass through openings in the stationary capsule body retention tray **68**. The vertical springs **114** have upper ends that exert an upward force against the capsule receiving tray **16** and lower ends that exert a downward force on a capsule body sealing plate **88**. The framework **70** is provided with tray support linkage **90**, which is a scissors linkage, that collapses to permit movement of the capsule receiving tray **16** toward the capsule body retention tray **68** without binding.

The bellcrank levers are mounted on the framework **70** and are rotatable to push the capsule cap retention tray **110** and the capsule receiving tray **16** together, downwardly toward the capsule body retention tray **68**, thereby overcoming the bias of the springs **114**. Actuation of the bellcrank levers **102** by rotation of those levers toward each other collapses the capsule cap retention tray **110** and the capsule receiving tray **16** together into a collapsed condition approaching the capsule body retention tray **68**. However, the bellcrank levers **102** are also counterrotatable to neutral positions to release the capsule cap retention tray **110**.

The capsule cap retention tray **110** is removed from the capsule receiving tray **16**. The capsule bodies **22** remain lodged in the capsule body gripping rings **76** and the capsule caps **20** remain lodged in the capsule cap grasping rings **136**.

This allows the multiplicity of capsule caps **20** to be concurrently separated from the multiplicity of capsule bodies **22**.

The process of recoupling the capsule caps **20** to the capsule bodies **22** and permanently sealing them together may be summarized as follows. After the capsule bodies **22** are loaded with a desired capsule filling substance, the capsule cap retention tray **110** is unidirectionally oriented upon the capsule receiving tray **16** guided by a flange projection extending from the back of the capsule cap retention tray **110**. The capsule cap retention tray **110** and the capsule receiving tray **16** are then pressed together and toward the capsule body retention tray **68**. The capsule bodies **22** are forced upwardly back through and outwardly out of engagement with the capsule body rings **76** while concurrently applying an opposing force against the capsule caps **20**. The capsule caps **20** are thereby concurrently replaced back on the capsule bodies **22** and the capsule caps **20** and the capsule bodies **22** are concurrently forced together. The capsule caps **20** and the capsule bodies **22** are thereby permanently engaged with each other and permanently sealed.

The framework **70** is comprised of releaseably engageable latches **160** to hold the capsule cap retention tray **110** and the capsule receiving tray **16** in a collapsed condition. The capsule sealing plate **88** is movable toward the capsule body retention plate **16** to a sealing position and away from the capsule body retention plate **16** to a retracted position.

The capsule sealing plate **88** is provided with a multiplicity of upwardly projecting ram posts **166** aligned with the capsule body retaining openings **80**. The capsule framework **70** supports the capsule sealing plate **88** parallel to and beneath the capsule body retention plate **68**. Movement of the capsule sealing plate **88** to the sealing position forces the capsule bodies **22** far enough into the capsule caps **20** to permanently seal the capsule bodies **22** to the capsule caps **20**.

Sealing lever linkages are also provided and are formed of push rods **148** and rocker arms **152**. The sealing lever linkages are located on the framework **70** and are coupled between the capsule sealing plate **88** and the bellcrank levers **102**.

Counterrotation of the bellcrank levers **102** beyond their neutral positions with the latches **160** engaged and the capsule cap retention tray **110** and the capsule receiving tray **16** latched by the latches **160** forces the capsule sealing plate **88** to the sealed position. That is, the capsule bodies **22** are pushed by counterrotation of the bellcrank levers **102** up into the capsule caps **20** until the radial sealing ribs **24** of the capsule caps **20** engage the radially outwardly directed sealing grooves **25**. The capsule shells **18** are thereupon permanently secured together in a sealed condition of state.

Undoubtedly, numerous variations and modifications of the invention will become readily apparent to those familiar with capsule loading machines. Accordingly, the scope of the invention should not be construed as limited to the specific embodiment depicted nor the implementation of the method described, but rather is defined in the claims appended hereto.

We claim:

1. A manually operated machine for separating a multiplicity of capsule shells having an oblong shape and capsule caps fitted telescopically onto smaller diameter capsule bodies comprising:

a capsule receiving tray having circular capsule receiving apertures therein of diameter large enough to permit passage of said capsule bodies therethrough and smaller in diameter than said capsule caps,

a capsule body retention tray located directly beneath said capsule receiving tray and having capsule body retaining openings with capsule body gripping rings therein that exert less frictional force against movement of said capsule bodies therethrough in a direction away from said capsule receiving tray than toward said capsule receiving tray,

a framework carrying said capsule receiving tray and holding said capsule receiving tray to said capsule body retention tray in an orientation parallel thereto, and including tray support linkage which collapses to permit movement of said capsule receiving tray toward said capsule body retention tray,

a capsule cap retention tray positionable directly atop said capsule receiving tray and having capsule cap receiving apertures therein equipped with capsule cap grasping rings that exert less frictional force against movement of said capsule caps therethrough in a direction away from said capsule receiving tray than in a direction toward said capsule receiving tray,

vertical biasing springs acting between said capsule receiving tray relative to said framework to urge said capsule receiving tray upwardly and away from said capsule body retention tray, and

a lever mechanism joined to said framework and operable against the force of said vertical biasing springs to entrap said capsule cap retention tray directly atop and in face-to-face contact with said capsule receiving tray, and press said capsule cap retention tray and said capsule receiving tray together toward said capsule body retention tray by collapsing said tray support linkage.

2. A machine according to claim **1** further comprising:

releaseable latches for holding said tray support linkage in a collapsed condition,

a capsule sealing plate having a multiplicity of upwardly projecting capsule body engaging posts aligned with said capsule body retaining openings, wherein said framework supports said capsule sealing plate parallel to and beneath said capsule body retention tray, and

sealing lever linkages mounted on said framework and engageable by said lever mechanism to raise said capsule sealing plate upwardly, thereby pushing said capsule bodies upwardly toward said capsule cap retention tray, whereby said lever mechanism has lever arms that are counterrotatable against said sealing lever linkages to raise said capsule sealing plate sufficiently to permanently seal said capsule caps and said capsule bodies together.

3. A machine according to claim **1** wherein said capsule body gripping rings are formed as resilient thin, circular annular wafers of metal having central cruciform openings defined therein with capsule body retaining flanges directed away from said capsule receiving tray.

4. A machine according to claim **1** wherein said capsule cap grasping rings are each formed as a resilient, circular annular structure.

5. A machine according to claim **1** further comprising a capsule orientation unit having an upper alignment plate defining a rectilinear matrix of oblong, horizontal, capsule drop slot having the same shape as said capsule shells and slightly larger than said capsule shells,

a capsule tipping plate located beneath said upper alignment plate and having tipping apertures therein shaped as said capsule shells but having opposing ends wider than said capsule bodies and narrower than said capsule caps and widened midsections, wherein said midsections have a length of between about fifteen percent and twenty percent of the total length of said tipping apertures, and

a funnel tray located beneath said capsule tipping plate and including a rectilinear matrix of funnels therein for receiving said capsule shells from said capsule tipping plate and discharging said capsule shells in an upright vertical orientation in which all of said capsule caps are located atop said capsule bodies.

6. A machine according to claim **5** wherein said funnel tray and said upper alignment plate are rigidly joined to each other and said capsule tipping plate is mounted between said upper alignment plate and said funnel tray and is movable in lateral reciprocal fashion relative thereto, whereby said tipping apertures are alternatively aligned and misaligned with said capsule drop slots, and further comprising alignment unit springs biasing said tipping plate to a condition in which said tipping apertures are misaligned with said drop apertures.

7. A machine according to claim **5** wherein said midsections of said tipping apertures have a length of about seventeen percent of the total length of said tipping apertures.

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